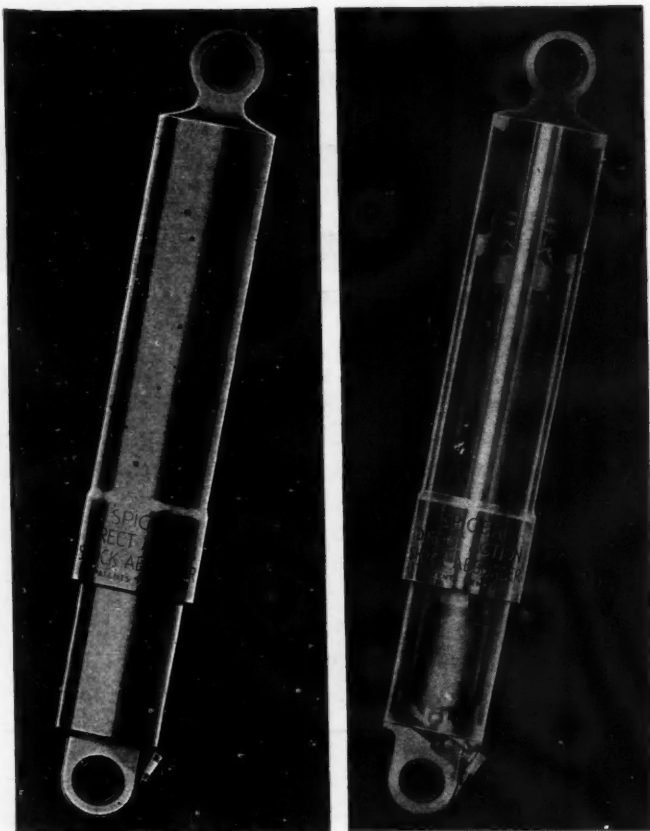


RELAXED RIDING

with NEW Spicer
Self Compensating
Shock Absorbers



Simple in design, effective in operation, Spicer Shock Absorbers require no attention, adjustment or refilling. They are standard equipment on many of today's easiest riding cars.

Spicer

MANUFACTURING CORPORATION
TOLEDO, OHIO

BROWN-LIFE
CLUTCHES and
TRANSMISSIONS

SALISBURY
FRONT and REAR
AXLES

SPICER
UNIVERSAL
JOINTS

PARISH
FRAMES
READING, PA.

October 20, 1934

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Reg. U. S. Pat. Off.



Volume 71

Number 16

JULIAN CHASE, Directing Editor

DON BLANCHARD, Editor

P. M. HELDT, Engineering Editor
JOSEPH GESCHELIN, Eng. Editor
ATHEL F. DENHAM, Detroit Editor

JEROME H. FARRIS, Asst. Editor
T. LAWTON SLAUGH, News Editor
GEOFFREY GRIER, Art Editor

Contents

News of the Industry.....	455
Business in Brief	462
Calendar of Coming Events.....	463
The Horizons of Business.....	464
Tolerances in Automotive Production. By P. M. Heldt	466
Just Among Ourselves	469
Paris Show Discloses Advancement in Streamlining and Independent Springing and a Greater Number of Models With Front Drives. By W. F. Bradley.....	470
Federal Mogul Tests the Efficacy of Copper Alloy Cylinder Heads	474
Independent Suspension for the Rear, Braking and Streamlining All Due for Development Says Crane	476
Fundamentals of Wear Studied by Bureau of Standards	478
Production Lines	479
Unique Production Set-Up Gives Mass Production Economies in Daily Output of 16 Pancake Engines. By Joseph Geschelin	480
Advertisers' Index	39

Automotive Industries is published every Saturday by

CHILTON COMPANY

Chestnut and 56th Streets, Philadelphia, Pa.

C. A. MUSSELMAN, President and General Manager

J. S. HILDBRETH, Vice-Pres. and Director of Sales

W. I. RALPH, Vice-Pres. G. C. BUZZBY, Vice-Pres.

W. A. BARBER, Secretary and Treasurer

GEO. D. ROBERTS, Advertising Manager

Cable AddressAutoland, Philadelphia

TelephoneSherwood 1424

OFFICES

New York—U. P. C. Bldg., 239 W. 39th St. Phone Pennsylvania 6-1100
Chicago—Room 1116 London Guarantee & Accident Bldg. Phone Franklin 9404.
Detroit—814 Stephenson Bldg. Phone Madison 2090.
Cleveland—1140 Guardian Bldg. Phone Main 6860.
San Francisco—Room 305, 444 Market St. Phone Garfield 6788.
Long Beach—1595 Pacific Ave. Phone Long Beach 613-238
Portland, Oregon—72 Fifth St.
Entered as second-class matter Oct. 1, 1925, at the post office at Philadelphia, Pa., under the act of March 3, 1879.

SUBSCRIPTION RATES: United States, United States Possessions, and all countries in the Postal Union, \$1.00 per year; Canada and Foreign, \$4.00 per year. Single Copies, 25c.

COPYRIGHT, 1934, CHILTON COMPANY

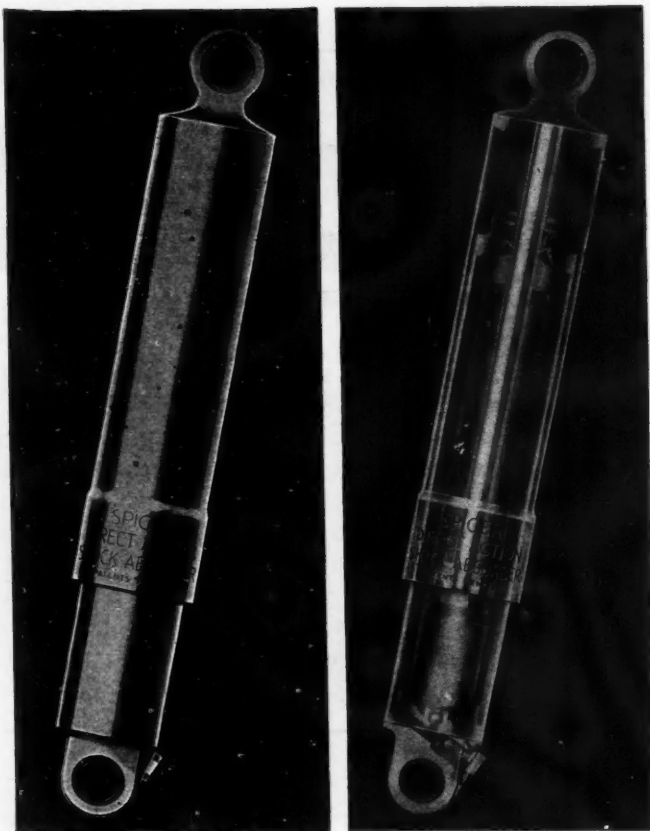
Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Automotive Industries

RELAXED RIDING

with **NEW Spicer**
Self Compensating
Shock Absorbers



Simple in design, effective in operation, Spicer Shock Absorbers require no attention, adjustment or refilling. They are standard equipment on many of today's easiest riding cars.

Spicer

MANUFACTURING CORPORATION
TOLEDO, OHIO

BROWN-LIFE
CLUTCHES and
TRANSMISSIONS

SALISBURY
FRONT and REAR
AXLES

SPICER
UNIVERSAL
JOINTS

PARISH
FRAMES
READING, PA.

October 20, 1934

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Reg. U. S. Pat. Off.



Volume 71

Number 16

JULIAN CHASE, Directing Editor

DON BLANCHARD, Editor

P. M. HELDT, Engineering Editor
JOSEPH GESCHELIN, Eng. Editor
ATHEL F. DENHAM, Detroit Editor

JEROME H. FARRIS, Asst. Editor
T. LAWTON SLAUGH, News Editor
GEOFFREY GRIER, Art Editor

Contents

News of the Industry.....	455
Business in Brief	462
Calendar of Coming Events.....	463
The Horizons of Business.....	464
Tolerances in Automotive Production. By P. M. Heldt	466
Just Among Ourselves	469
Paris Show Discloses Advancement in Streamlining and Independent Springing and a Greater Number of Models With Front Drives. By W. F. Bradley.....	470
Federal Mogul Tests the Efficacy of Copper Alloy Cylinder Heads	474
Independent Suspension for the Rear, Braking and Streamlining All Due for Development Says Crane	476
Fundamentals of Wear Studied by Bureau of Standards	478
Production Lines	479
Unique Production Set-Up Gives Mass Production Economies in Daily Output of 16 Pancake Engines. By Joseph Geschelin	480
Advertisers' Index	39

Automotive Industries is published every Saturday by

CHILTON COMPANY

Chestnut and 56th Streets, Philadelphia, Pa.

C. A. MUSSELMAN, President and General Manager

J. S. HILDBRETH, Vice-Pres. and Director of Sales

W. I. RALPH, Vice-Pres.

G. C. BUZZBY, Vice-Pres.

W. A. BARBER, Secretary and Treasurer

GEO. D. ROBERTS, Advertising Manager

Cable AddressAutoland, Philadelphia

TelephoneSherwood 1424

OFFICES

New York—U. P. C. Bldg., 239 W. 39th St. Phone Pennsylvania 6-1100

Chicago—Room 1116 London Guarantee & Accident Bldg. Phone Franklin 9404.

Detroit—814 Stephenson Bldg. Phone Madison 2090.

Cleveland—1140 Guardian Bldg. Phone Main 6860.

San Francisco—Room 305, 444 Market St. Phone Garfield 6788.

Long Beach—1595 Pacific Ave. Phone Long Beach 613-238

Portland, Oregon—72 Fifth St.

Entered as second-class matter Oct. 1, 1925, at the post office at Philadelphia, Pa., under the act of March 3, 1879.

SUBSCRIPTION RATES: United States, United States Possessions, and all countries in the Postal Union, \$1.00 per year; Canada and Foreign, \$4.00 per year. Single Copies, 25c.

COPYRIGHT, 1934, CHILTON COMPANY

Member of the Audit Bureau of Circulations

Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Automotive Industries

Sales Up; Oct. Nears 160,000

November May Be Production Low Point With Only 75,000



F. J. Dillon, A.F.L. organizer at Detroit. "... majority rule ... only practicable method of ... collective bargaining." See page 459

by Athel F. Denham

Detroit Editor, Automotive Industries

Largely due to a pickup in truck sales, total domestic retail deliveries of new cars and trucks for the month of October appears to be headed for the 160,000 mark.

It is to be expected, moreover, that price reductions on major lines during the past week or so will also have a stimulating effect on passenger car sales, so that a total close to 170,000 is not impossible.

With production totals for the industry for the month still calling for roughly 145,000 units, including Canadian and

export, the result will be a striking reduction in new car and truck dealer stocks for the month.

It will not be at all surprising to see the month drop new vehicle stocks by 50,000 to 60,000 units, which, in view of the lateness this year of new model announcements, indicates that disposals will have been pretty well taken care of by the time 1935 models get in real production in December or January.

Except for the possibility that shortages of certain body models may actually occur in some lines during November, the latter month should be the low point for the year production-wise. From present indications it does not appear probable that total production for that month will exceed 75,000 to 80,000 units.

ASA Calling Conferences to Formulate Vehicle "Performance Safety" Standard

In an effort to reduce the terrific loss of life and the huge accident toll on the highways, the American Standards Association will call conferences of interested groups looking toward a national "performance safety" standard for motor vehicle safety.

The National Bureau of Casualty and Surety Underwriters has asked the association "to initiate a project looking toward the creation of such standards," embracing all mechanical equipment which has a bearing on the safe operation of cars, buses, and trucks, it was announced today.

Motor vehicle manufacturers, automotive engineers, brake lining and parts manufacturers, motorists' associations, bus and truck operators, insurance interests, and state motor vehicle administrators will be asked to present their points of view. If the project appears to be feasible, a committee of representatives of these groups will be appointed as a committee to write a code of requirements for brakes, headlights, steering gear, tires, etc., under the procedure of the American Standards Association.

The Insurance Group, in making their request, pointed out that their statistics show that between 10 and 15 per cent of motor vehicle accidents are caused by faulty condition of the automobile, rather than by the fault of the driver himself.

"For a number of years," the statement said, "the National Bureau of Casualty and Surety Underwriters has had as one of its activities the promotion of the periodic inspection of automobiles in regard to the safety features of their equipment, and we have had a part in the initiating and carrying on of such work in some 20 states.

"These campaigns have amply demonstrated the need for such work."
(Turn to page 463, please)

IN THIS ISSUE

Tolerances in automotive production is a subject that has been untouched until now. Some real enlightenment on page 466.

W. F. Bradley has sent in a very complete report of the Automobile show at Paris. You will find it on page 470

Henry M. Crane has made some interesting observations. Read them on page 476

The production problems of the new White Pancake engine have been solved in a unique way. See page 480

Code Enforcement Up to FTC, Justice Department

President Roosevelt made his intentions regarding code enforcement under the reorganized NRA clear this week when he issued an informal statement to the effect that this problem would be left in the hands of the Department of Justice and the Federal Trade Commission. The work, however, will be greatly expedited through greater coordination than heretofore between these departments.

It was also announced, following a White House conference in which Donald Richberg, director of the NRA policy commission, participated, that no new legal agency would be established.

U.S. Courts Uphold Price-Fixing Rule

Recent Decisions Even Score in Fisher Lumber Corp. Dispute at 2-All

This week the tide turned more favorably for the government in legal proceedings to sustain the legality of price fixing provisions in codes, despite the ascending tendency of the Administration to relax its watchfulness on these and production control provisos, when two Federal District Courts upheld the validity of the price fixing articles of the Lumber Code.

Federal Judge Martineau, presiding at a hearing in Chambers at Little Rock, Ark., on a government petition to restrain six Arkansas lumber firms from violating price provisions of that industry's code through the sale of lumber to the Fisher Lumber Corp., GM subsidiary. At the same time Judge Martineau made it plain that he was not in any manner passing upon the constitutionality of N.I.R.A. but merely expresses

that if this class of legislation is held to be constitutional it would be necessary for such prices to be fixed if the law is to be made effective.

At Monroe, La., Judge Ben C. Dawkins, of the Western Federal District of Louisiana, granted a temporary injunction restraining three firms in that state from violation of the same provision.

In the case of the Fisher Lumber Corp. dispute decisions this brings the score to 2-2. Last week Federal Judge Harry Anderson, presiding over the Western District of Tennessee, at Memphis, and Federal Judge Edwin R. Holmes of the Southern District of Mississippi, refused to grant injunctions against lumber dealers charged with violations of the price provisions in the Lumber Code for selling to the Fisher Lumber Corp. at prices under those fixed in the code.

While the decisions were being made relative to the Lumber Code situation two others were being heard by Federal judges relative to the Motor Vehicle Retailing Code. These cases were reported in the Oct. 13 issue of *Automotive Industries* on page 431.

Engineers Must Heed Economic Conditions

Grant Tells Detroit SAE Future Vehicle Must Fit Purchasers' Pocketbooks

Virtual endorsement of the fundamental soundness of the dealer code, criticism of over-expansion of dealer organizations in recent years in proportion to sales potential, a prediction that 1935 would be at least as good, automotively speaking, as 1934 and a plea for lower car prices—all these were among the highlights of an address by Richard H. Grant, vice-president in charge of sales, General Motors Corp., before the dinner session of the Society of Automotive Engineers' annual production meeting in Detroit last week.

"Engineering in the future must give more definite heed to economic considerations," Mr. Grant said. "If we had realized this before we would have today vehicles vastly better than we now have—vehicles which would fit the shrunken pocket-books of today."

Mr. Grant pointed out in his address the close relationship between engineering design and such questions as the dealer code. Tracing developments of recent years when car manufacturers put on, or kept on more dealers than were economically justifiable—with overtrading of used cars, etc., he pointed out that the industry has continuously endeavored to sell the public more cars than it could justifiably absorb at current prices.

To this he credited the high dealer turnover of recent years, emphasizing that not until the code went into effect, did dealers become sellers instead of buyers of cars.

If the code is to continue, if horse-trading is to be relegated to a more minor position in automotive retail merchandising, Mr. Grant said, there will be imposed on the engineering and manufacturing fraternity the necessity of designing and producing cars which will excel competition without overtrading.

To emphasize this point, Mr. Grant stated that investigation has disclosed that 75 to 80 per cent of new car customers go to dealers on account of what friends, service men, or advertising has told them about the vehicle, and that only 20 per cent of all sales is creditable to the direct selling side of the business.

As to car design in general, Mr. Grant said, in part: "Never before in our history have we known less of what our automobiles ought to look like two years hence. Today this industry is badly in need of a group of engineers who can foretell another five year period of general car design." Mr. Grant added his belief that functional considerations would be given more prominence in the future evolution of the automobile.

Chevrolet Adds 4-Door Sedan to '34 Standard Six Line Priced at \$540

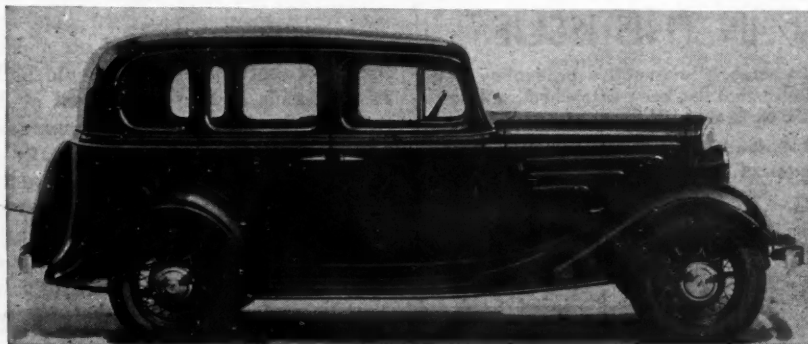
For the first time since Chevrolet added the Standard six in 1933, a four-door five-passenger sedan is now included in its lower priced line. Its list price is \$540, or \$100 under the Master four-door sedan.

The major new feature in styling is the treatment of the rear end, where the body panels extend low in an unbroken contour to cover the back of the chassis. This construction does away with the rear cross-member cover, and provides a smooth, sweeping effect. The rear tire carrier and the rear bumper supports extend through openings in the body panel, as does the gasoline tank filler-neck.

Comfort for rear seat passengers is

improved by provision for extra leg room, the back of the front seat being deeply recessed, giving plenty of space for a built-in foot rest. Maximum elbow room is obtained by means of deep recesses in the sides of the body above large arm rests. A capacious pocket in the back of the front seat is an added convenience. Upholstery is of mohair material of a new shade and texture, set off by harmonizing head-lining.

Equipment features include an adjustable sun-shade at the driver's seat, button type latches for locking all doors, dome light, and rear window curtain. The front doors are equipped with no draft venti-panes, fitted with exterior rain shields.



NRA Drafts Thorp; Move Believed Step Further Toward Let-Up In Price Fixing

The drafting into NRA service of Dr. Willard L. Thorp as associate economic adviser to the National Industrial Recovery Board, and the reported impending appointment of Dr. Robert Maynard Hutchins, president of the University of Chicago, as code coordinator, places definite emphasis upon two subjects now being widely discussed by administration leaders—that Washington contemplates a drive for code enforcement more rigid than in the past, through inducing industry to take the lead in its own government, and that serious consideration is to be given the matter of definitely relaxing both price fixing and production control features of the codes.

The desire of the administration for industry to take the lead in enforcing codes was emphasized by Stephen Early, White House secretary, following a White House conference between President Roosevelt and the NRA administrative board.

"The President and the board," said Early, "want to give industry a chance to clean out the chiselers."

The conference is understood to have turned almost entirely upon the matter of compliance, viewed as of growing importance. To this end plans are being made to enforce codes more vigorously, with the aid of industry itself, by coordinating the machinery of the Department of Justice and the Federal Trade Commission, to be operated within the NRA. It has been reported that the work of coordination will be placed in charge of Dr. Hutchins, who also has been mentioned as the possible successor of Lloyd Garrison as chairman of the National Labor Relations Board. The drive is directed toward enforcement of fair trade practice and price provisions of codes while at the same time there is at least temporary cessation of the tendency to prosecute labor cases.

At the same time, it was indicated that much attention is to be given to price fixing. Relaxation of both price fixing and production control in codes was apparently given further consideration in the appointment of Dr. Thorp, price expert of the National Emergency Council, as associate economic adviser to the Board in the Division of Research and Planning and chairman of the advisory council. While Donald Richberg has attempted to allay concern shown by industry over fears that all price fixing and production control provisions would be eliminated from codes, it appears clear that there will be considerable modification of these provisions. Mr. Richberg has pointed out that these provisions will be studied "industry by industry" and that they will be maintained in at least some industries, particularly natural resource industries. Apprehension over his earlier remarks, he claimed, was due to misinterpretation.

Dr. Thorp, former economic professor at Amherst College, will be charged with passing on many such provisions before recom-



Dr. Robert Maynard Hutchins

mendations go to the administrative board. He is known as an opponent of price-fixing. Dr. Thorp fills a vacancy due to the resignation of Dr. Walton Hamilton, who resigned as chairman of the Advisory Council to become a member of the newly established National Industrial Recovery Board.

In its reorganized form, the advisory council includes two members each from the industrial, consumers' and labor advisory boards as well as one research and planning member and one legal division member. A ninth member of the advisory council, to be a special assistant to the administrative board, will be named soon.

Reeves to Address Detroit Rotary Club

Alfred Reeves, vice-president of the Automobile Manufacturers Association, will address the Detroit Rotary Club on the subject, "Recovery Rolls on Rubber Tires." Mr. Reeves' talk is scheduled for Wednesday, Oct. 24.

In his talk the representative of the manufacturers is expected to review the industry's recovery program and to discuss some of the problems confronting the industry, including those in the fields of taxation, traffic control, accident prevention and labor relations.

Logan Gear Stockholders OK to RFC Loan Sought

Stockholders of the Logan Gear Co., Toledo, have been called to meet at the offices of the Bingham Stamping & Tool Co., its subsidiary, Oct. 22, to approve terms of a loan not to exceed \$200,000 from the Reconstruction Finance Corp.

GM Industrial Relations Statement Sent Workers

The General Motors Corp. statement, "A Statement of the General Motors Corporation's Basic Policies Governing Its Relations with Employees," released this week to the public press and sent to more than 130,000 GM workers, was first published in full in *Automotive Industries* in the issue of Sept. 15, on pages 322-324.

Authority to mortgage the plans will be sought from the shareholders. Because of default in dividends the preference shares may exercise the sole voting power at the meeting.

C. O. Miniger, chairman of board; William H. Schomburg, vice-president and general manager, and G. L. Mouen, director, are the proxy committee.

Plan No Code Changes Affecting Steel Prices

No changes in the Steel Code which would affect prices are being considered, according to a statement by Donald R. Richberg, chief of the Policy Committee of the NRA, following a meeting of the board of directors of the American Iron and Steel Institute in New York, last week.

The chief aim of the new NRA control is to promote stability and no policies affecting sudden and drastic changes in codes would be inaugurated, he said.

Mr. Richberg expressed satisfaction with the operation of the Steel Code and declared it "exceptional" as to compliance.

Federal Gets \$1,000,000 Government Truck Order

An order for 399 trucks, cabs and bodies totaling close to a million dollars has been awarded by the War Department to the Federal Motor Truck Company, according to M. L. Pulcher, president of Federal.

These trucks, all of 2½ ton capacity, will be of special 4-wheel drive design, built to government specifications. The standard tire equipment is to be pneumatic single front and dual rear, but provision is made through the use of special design front hubs for the installation of dual front tires in case of necessity.

Each truck will be furnished with an enclosed driver's cab and an army cargo type body fitted with troop seats and a tarpaulin top. The cabs and bodies are to be built in Federal's own body shop.

Varied Social Aid Program Studied

Eleven Separate Groups at Work on Legislation to go Before Congress

The widely varied aspect and scope of the social legislation program which will be placed before the next Congress was evidenced this week when the extent of the studies and investigations of the President's Committee on Economic Security became known. This committee is now considering 11 separate phases of the problem.

Leading authorities in their respective fields have been named by the committee, according to the committee's first public report, to report in detail upon such matters as unemployment insurance, provisions for old-age security, meeting the economic risks of illness, public works as a means to economic security and employment opportunities. Other aspects under consideration include survivor's insurance, special measures for the economic security of children, dependency and relief, economic security for farmers and agricultural workers, handling and investment of reserve funds, fiscal aspects of the security problem.

One of the chief difficulties in instituting such a social aid system as this report contemplates will be the question of financing.

The matter of financing such an ambitious program has been placed with an "actuarial" sub-committee led by Professor James W. Glover of the University of Michigan. In addition to the experts now working on the program the President may call upon representative citizens to aid in working out some of the problems.

The committee on economic security is composed of Secretaries Perkins, Morgenthau and Wallace, Attorney General Cummings and the Federal Relief Administrator, Harry L. Hopkins.



Hudson cars equipped with bullet-proof glass and windshield gun ports have been put in service by the Detroit Police Department

Factory Relations Occupy NADA Heads

Permanent Committee to Handle Problem Planned at St. Louis Meeting

Resolutions affecting factory-dealer relationships and contemplating the appointment of a permanent committee to carry on negotiations with a view to remedying unfavorable situations and bring about better relations between these two divisions of the automotive industry were the highlights of the special meeting of the directors of the National Automobile Dealers Association held this week in St. Louis.

During the meeting F. W. A. Vesper, president of the NADA, told the directors it was his belief that as a result of negotiations carried on during the past months factory-dealer relationships appeared much closer to solution than at any time in the past. The directors also adopted a resolution instructing the association to take steps to obtain legislation looking toward the permanent establishment of fair trade practices in the Motor

Vehicle Retailing Code.

Plans concerning the official guide book for 1935 were approved and a program adopted for the purpose of strengthening the membership through cooperation with present state associations and the creation of associations in those states where none at present exist.

Other resolutions adopted included the principle of equitable mark-up on freight. The extent to which association activities are interwoven with code operations was forcefully brought out in the discussions.

The annual NADA meeting will be held in Detroit during show week.

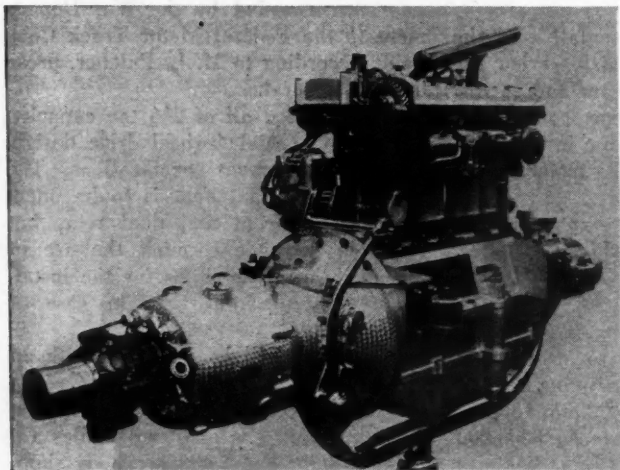
More Factories OK Price Cut Requests

Dealer applications to code authorities to cut list prices for clean-up purposes began thinning out this week. Up to last week such requests for authorization from the various state advisory committees came so fast that it was plainly evident the annual clearance move was in full swing.

This week, according to latest advices, other factories, including Dodge, Studebaker, Oldsmobile, and Buick, have authorized dealers to request permission to cut prices. However, no official action on these requests had been reported by the state advisory groups up to closing time. Lincoln also has authorized its dealer organization to apply for price reductions.

Previously cuts had been authorized on Plymouth, DeSoto, Pontiac, Graham, Hudson, Hupp, Terraplane and on one body model each in the Nash Advanced Eight, LaFayette and LaSalle.

It is understood that Buick's authorization did not include the entire line but only certain of the models. Also it is reported that Ford has authorized dealers to request permission to cut prices on the open body models.



This Salmon four-cylinder engine with Cotal planetary transmission with electric control was shown at the Paris Show last week. See page 470

Government's Attitude Toward NLRB Prosecutions Indicated by Houde Case

Industry this week lost an opportunity for a clear-cut definition of "collective bargaining" and a decision on the legality and extent of the National Labor Relations Board's authority to enforce its orders when the Department of Justice, temporarily at least, dropped prosecution of the Houde Engineering Corp. The decision in this case, a *cause célèbre* in labor disputes, is being nationally anticipated by both industrial leaders and the A. F. of L. because of its far-reaching effects upon these moot subjects.

Lack of evidence, and a probable reluctance on the part of the Department of Justice to lock horns with an industrial organization in a show-down court fight on such a befuddled and poorly defined terminology as "collective bargaining" loom as the factors influencing the department to sidestep the Houde case. However, in announcing the decision the Justice Department explained that its action was not to be construed as an indication that any doubt of the legality of NLRB's rulings in this particular dispute are entertained.

Obviously the National Labor Relations Board stands to lose prestige through the action of the D. of J. because of the importance of the case. But on the other hand so does the Department of Justice stand to "lose face" if it goes into court with a case lacking support of convincing or convicting evidence. Courts have not dealt too leniently with the Department of Justice in some code cases, though not labor cases, and consequently this department has become chary of taking into court any more NRA "test" cases than is necessary. At the same time the Supreme Court of the United States now has before it a number of test cases and it is altogether likely the Department prefers to observe the outcome of these before plunging into more trials.

However, at a press conference Wednesday, Lloyd Garrison, chairman of the National Labor Relations Board, denied that the Department of Justice has dropped the case. He declared that it is still under consideration, and that the union is seeking additional evidence with a view to urging prosecution.

In connection with the Garrison statement that the A. F. of L. is continuing its efforts to develop sufficient evidence against Houde to warrant prosecution, F. J. Dillon, the Federation's general organizer in Detroit, is reported to be of the opinion that a conference held between the A. F. of L. representatives in the Houde plant and the management, subsequent to the recent NLRB decision, provides a sufficient legal basis for prosecution.

Mr. Dillon's statement follows:

"It is our understanding that the present status of the Houde Engineering Company case is that legal action is definitely being undertaken by the U. S. Department of Justice in the usual manner, and at the present moment is only awaiting further preparation of the details in the case. The local union involved, United Automobile Workers Federal Labor Union No. 18839, had a conference with the management sub-

sequent to the decision of the National Labor Relations Board in which the management refused to abide by the decision of the Board, which provides that the majority has the legal right to be the official collective bargaining agency for all employees. It is our understanding that as soon as the facts of this conference, and the remainder of the record can, with the cooperation of the attorney of the American Federation of Labor in the automobile industry, Charlton Ogburn, be presented to the Board and transferred from there to the Department of Justice, action will get under way very shortly.

"The principle of majority rule, as set forth in the decision of the National Labor Relations Board in this case, is the only practicable method of working out collective bargaining between employers and employees. The manufacturers' avowed preference for other schemes of representation is actuated solely by their desire to discourage organization of their employees into legitimate trade unions, and should be dealt with by the government in summary fashion."

To the informed observer it appears obvious, on the face of the situation at least, that industry is to be treated to a truce in labor prosecutions, and that the Board has been served notice that it must ease up a bit in its efforts to make cases out of insufficient evidence.

"The present falling down in the Houde case has been accepted as setting an important precedent, for upon its decision, the Board built the principle which brought about decisions against such important concerns as the Guide Lamp Co., the Kohler Co., and the Baldwin Shovel Co. The belief prevails that these latter cases now are doomed to fail. Also the much-touted Blue Eagle apparently could roost in peace at the plants of these concerns, and they

NEXT WEEK

The Production Issue with several new features to interest and help you.

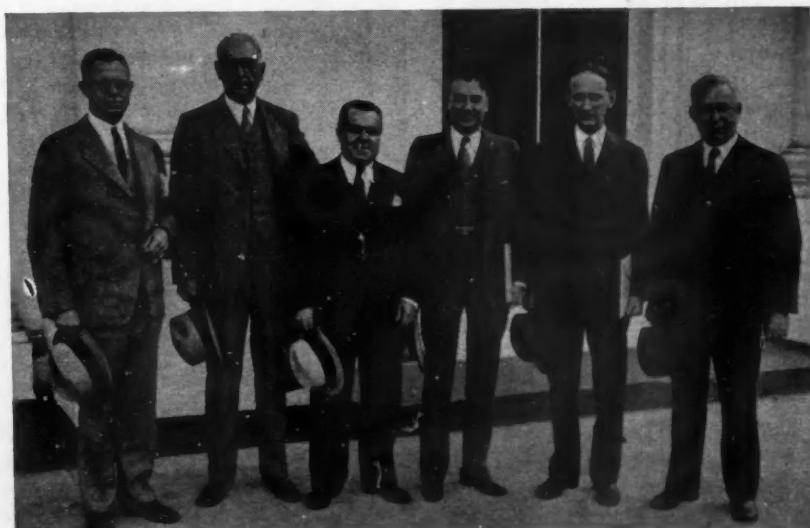
It will be the sort of issue that will be on your desk for months as a reference book.

would in no way be barred from government business, nor would automotive and other interests buying from them be shut out from such business."

The drive of the American Federation of Labor for the majority principle, however, promises to be intensified, rather than diminished. This was seen when the Federation turned "vertical." The change was forced by the automotive workers who want to knit themselves into a single unit with some 400,000 members. They are proceeding on the code theory of organizing "industry by industry."

Ford Co. Subscribes to Canadian Refunding Loan

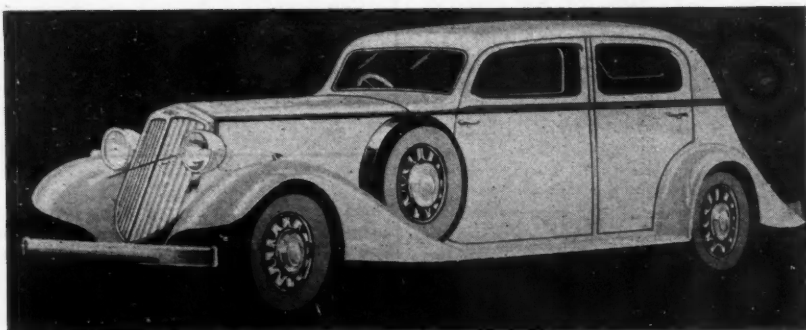
Canada's refunding loan was given a substantial aid with a subscription of \$2,500,000 from the Ford Motor Company of Canada, Ltd. Wallace R. Campbell, president and treasurer of the company, advised Dr. H. C. Clark, Deputy Minister of Finance, of his company's intention to take out a subscription in that amount. The company is also encouraging its employees to subscribe, Mr. Campbell said.



Spokesmen for the National Highway Users Conference who conferred with President Roosevelt this week on legislation for the coordination of transportation agencies

From left to right—Arthur M. Hill, Pres. Nat'l Ass'n of Motor Bus Operators, Charleston, West Va.; Herbert P. Sheets, Pres. National Retailers Council, Indianapolis, Ind.; Ted V. Rodgers, Pres. American Trucking Ass'n., Inc., Scranton, Penna.; Roy F. Britton, Director, National Highway Users Conference, Washington, D. C.; Chester H. Gray, Washington Representative, American Farm Bureau Federation, and Fred Brenckman, Washington, D. C., Rep. The National Grange

Australians Plan Production of Two Low Priced Cars for Domestic Market



The Southern Cross. This car has a wheelbase of 120 in. The list price is £295

MELBOURNE, AUSTRALIA (By Mail)—Plans for the production of two Australian-made cars, the Buckingham produced in Victoria, and the Marks Southern Cross produced in Sydney, are now being completed. The Buckingham 60 is to be manufactured by Buckingham & Ward of Melbourne, at their Footscray Works, with considerable help in the production of forgings, pressings, etc., from the Government munition works at Maribyrnong. The first model carried a four-cylinder overhead-valve engine, but this has now been replaced by a similar six-cylinder engine. The car, which has undergone extensive road tests, has a wheelbase of 110 in. For regular production a large factory, formerly a foundry, has been secured at Geelong.

Sir Charles Kingsford Smith, the famous Australian flier, is chairman of the board of the Sydney company which plans to sell sedan models of the Southern Cross at £295, this price being based on a production rate of 200 cars per month. Contracts for the manufacture of parts will be given to established manufacturers of gears, wheels, electrical units, etc.

The Southern Cross is the design of J. A. Marks, at one time an airplane designer in Great Britain, who later was associated with the production in Sydney of an experimental frameless car known as the Marks Moir. The first Southern Cross was completed in June, 1933, and tests and development have been carried on since that time. Novel mechanical features include a four-cylinder horizontal opposed engine and multiple-leaf (24 thin leaves) half-elliptic chassis springs claimed to eliminate the need for shock absorbers.

Of most interest, however, is the design of the body which serves also as a chassis frame. It is built of laminated wood on formers to the finished shape.

Ten plies of selected aircraft plywood are used. Advantages claimed for this construction are ease and cheapness of repairs, crashproofness, elimination of weaving, squeaks and rattles, and very low total weight.

The production model of the Southern Cross has just been completed. Its only imported parts are the carburetor and the dashboard instruments. The car has a wheelbase of 120 in., a tread of 56½ in., a four-cylinder horizontal opposed engine of 3½-in. bore and 3¾-in. stroke developing 60 hp. at 3200 r.p.m., valves operated directly from overhead camshafts, and belt-drive for the generator and fan, the latter being mounted on an extension of the armature shaft. The total weight is 2240 lb., and the gas mileage is given as 30-35 per Imperial gallon. The carburetor is of the down-draft type, clutch and transmission are integral with the engine, transmission gears are of the silent type, and a fourth over-drive speed is provided, with a re-

The Buckingham. It has a 110 in. wheelbase. Government munitions plant is supplying parts



duction ratio of 2.95 between crankshaft and road wheels, the ratio of the direct drive third being 4.3. The body, while mainly of plywood construction, is sheathed with steel, for better contouring and better finish.

Dinner Meeting Supplants MEMA Membership Session

The Motor and Equipment Manufacturers Association will hold an informal members' dinner meeting in Cleveland on Tuesday, November 20, at the Hotel Cleveland during the week of the Automotive Service Industries Show.

This dinner meeting, which is scheduled to begin at 6.30 p. m., will be the annual members' business meeting and will supplant the session or sessions held during the daytime in former years. This arrangement, it is believed, will give all members an opportunity to spend the full day at the Automotive Service Industries Show or on other business and will also provide a better setting for the discussion of Association business. New officers and directors for 1935 also will be presented to the membership at this time.

John Howard Seriously Ill in Pontiac Hospital

John Howard, in charge of sales in the South for General Motors Truck, is reported to be seriously ill in the Pontiac Hospital. Mr. Howard was formerly advertising manager for GMT, and previously held a similar position with Federal Motor Truck.

Bonbrights Have Twins

John M. Bonbright, technical publicity writer for Chevrolet Motor Co., became the father of twins, a son, John Miller Bonbright, Jr., and a daughter, Cecilia M., on Oct. 11.

Steel Price Question Seen Hindering Orders

Automotive Consumers Seen Reluctant to Make Commitments at Present

The steel market continues to live largely on hope. According to the American Iron and Steel Institute, 3.4 per cent less of the industry's ingot capacity is employed this week than in the preceding week. Among finished products, demand for automobile sheets makes the best showing. Some of this business is ascribed to the covering of initial requirements for new models, while by the side of it continues a certain amount of last-minute filling in for current model parts and bodies.

Quite a few prominent automotive consumers, however, are still hanging back. Whether this is due to their unwillingness to commit themselves for anything like tonnages one day sooner than is absolutely necessary to take care of their November production schedules, or whether their holding off is due to a conviction that steel prices will be revised downward, is the cause of many headaches to steel sellers this week.

Developments in the last few days have fortified somewhat the position of those steel producers who believe that prices should be left unchanged. On the heels of reports that the leading interest would resort to wage cuts came news of an exchange of views between the new head of the NRA policy board and the steel manufacturers, resulting in information to the press that the code set-up of the steel industry would be pretty much left as it is. On top of this came news from Washington that Myron C. Taylor, chairman of the board of the United States Steel Corporation, conferred with President Roosevelt. The steel industry continues to sit on guard lest sniping by outside unionists upset their program of peaceful relations with their employees through the adjustment of all differences with representatives of their own workers and not of outsiders. Demand for strip has dipped moderately, while that for cold finished bars and alloy steels is a shade more active.

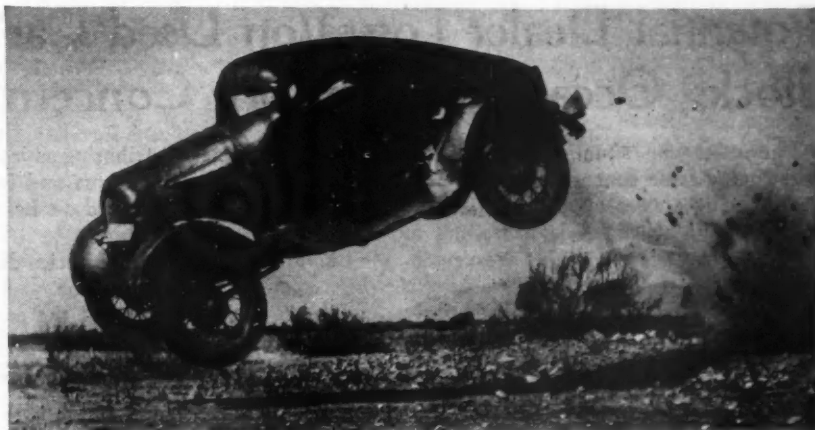
Pig Iron—Most of the shipments to automotive foundries consist of one or two carloads. Tonnage buyers are still holding off in the expectation of price revisions, which blast furnace interests declare to be remote.

Aluminum—The market is of a routine character, with the price situation entirely unchanged.

Copper—Buying by consumers is very light. In the outside market electrolytic is quoted at 7½c, delivered Connecticut, the Blue Eagle price continuing at 9c.

Tin—Spot Straits was quoted at 50½c. at the beginning of the week, a shade easier than at the close of the preceding week. A fire in one of the bonded warehouses is reported to have done some damage to tin stocks held there. It is significant that the market took notice of this incident, warehouse stocks being very light at present.

Zinc—A rise of \$1 per ton in the Joplin ore market caused a firmer tone in the metal.



A fool proof car? So David G. Hall, San Diego, Calif., designer and builder claims. The car, according to Mr. Hall can take turns at 60 m.p.h.

Detroit Safety Council Reelects Keller Head

K. T. Keller, vice-president and general manager of Chrysler Corp., has been re-elected president of the board of trustees of the Detroit Industrial Safety Council, according to an announcement following the annual meeting on Saturday.

Marvin A. Heidt, personnel director of the Budd Wheel & Mfg. Co., was named chairman of the board of directors of the council, succeeding C. T. Winegar, personnel director of the Chrysler Corp.

Walter O. Briggs, president of Briggs Manufacturing Co., was made a vice-president of the council. Other vice-presidents re-elected are C. W. Avery, G. R. Fink, E. F. Fisher, William S. Knudsen and A. C. Marshall.

Automotive Subjects On API Convention Agenda

Topics of interest to automotive engineers occupy a major place in the program for the Wednesday sessions of the annual meeting of the American Petroleum Institute to be held Nov. 13 to 15 in Dallas, Tex.

Among the papers scheduled are:

Lubrication of Solid Injection Engines, by W. G. Gordon, Socony-Vacuum.

Extreme Pressure Lubricants, by H. C. Mougey, General Motors.

Improved Motor Oils, by M. Otto, F. L. Miller, A. J. Blackwood and G. H. B. Davis, Standard Oil Development Co.

The Evaluation of the Ignition Characteristics of Diesel Engine Fuel Oils, by C. C. Moore, Jr., and G. R. Kaye, Union Oil Co.

Economic Status of the Automotive Diesel Engine in Road Transportation, by Joseph Geschelin, Automotive Industries.

Fuel for Rail Cars, by D. P. Barnard IV, Standard of Indiana.

Report of Cooperative Fuel Research Committee on 1934 Detonation Road Tests, by C. B. Veal, S.A.E., and secretary of the committee.

ACF Spokesman Denies Berwick Closing Rumor

An official of the American Car and Foundry Corp., speaking for the corporation this week, denied a rumor that the organization plans permanently closing the Berwick, Pa., plant.

"It is possible that the freight car or steel passenger car plant is nearing the end of a contract," the officials said, "and consequently will be closed pending receipt of new orders. But there has been no suggestion at any time that the entire plant be permanently closed. It would be impossible to entertain such a plan for the reason that other divisions are neither equipped nor large enough to handle some of the work done at Berwick. The foundry and rolling mill located at Berwick are essential to the corporation's continued operation."

LeRoi Co. Gets \$60,000 Gov't. Generator Job

LeRoi Co., Milwaukee, has booked a Government order calling for 206 five-kilowatt gasoline engine electric generator units for use in Civilian Conservation Corps camps in various sections of the country. The order is valued at about \$60,000.

Heyd Returns to Rusco

After an absence of one year, William F. Heyd has been reappointed as salesman in the automotive department of the Russell Manufacturing Company. His headquarters will be in the Detroit office of the company in the General Motors Building.

Youth Threatened Edsel Ford, Jailed

**Demanded \$5,000 From Son
of Motor Magnate; Sent to
Leavenworth for 10 Years**

It cost a 20-year-old youth 10 years of his life behind prison walls for threatening death to Edsel Ford unless Mr. Ford paid him \$5,000. The boy, Edward Lickwala, was sentenced to serve his term in the Federal Penitentiary at Leavenworth by Judge Edward J. Moinet.

The sentence was imposed by the jurist a few minutes after Lickwala had pleaded guilty to the charge of sending Mr. Ford a letter in which the demand was made for the \$5,000 in \$5 and \$10 bills and that it be put in a candy box at a designated spot. Little time was lost in indicting the youth after his arrest in what was almost record time by Department of Justice agents.

When the grand jury received the case it took but a few minutes to return the indictment, and just as speedily Lickwala was arraigned and sentenced following his plea of guilty. Lickwala is reported to have told the Court: "I never meant to kill him. I just wanted to scare him. He's got a lot of money and I wanted some of it."

Only two witnesses were called by the grand jury. They were Hazen J. Behrens, a clerk at the Ford Motor Co., whose testimony established receipt of the letter by Mr. Ford, and William Larson, chief of the Department of Justice in Detroit, who related details of the investigation which led to the youth's arrest.

A.S.A. Calling Conference

(Continued from page 455)

strated the effectiveness of inspection in reducing accidents; because the accident experience in the states where such campaigns have been held, during the period immediately following such inspections, has in general shown a marked improvement."

Although the reduction of accidents attributable to faulty mechanical equipment is comparatively small, it has been shown that correcting such faults is the first step in educating motorists to drive with more caution. In the industrial accident field, it has been found that providing machinery with guards and other safety appliances is the necessary first step in waging war on the accident toll. A national standard for "roadability" of motor vehicles is expected to go far in curtailing reckless driving.

Although motor vehicle fatalities showed an improvement during 1932, there has been a steady increase for the past two years, with 30,500 recorded for 1933 and an estimate of 36,000 deaths for this year, according to the National Safety Council.

During the present decade, 290,000 men, women and children will have been killed

in motor vehicle accidents, and 10,000,000 will have been injured.

Among the national associations and groups which will be invited to participate in the preliminary conferences to be held by the American Standards Association, will be the Society of Automotive Engineers, Automobile Manufacturers Association (formerly National Automobile Chamber of Commerce), American Automobile Association, American Motorists Association, American Association of Motor Vehicle Administrators, American Trucking Associations, Inc., Motor & Equipment Manufacturers Association, National Standard Parts Association, National Association of Motor Bus Operators, National Association of Taxicab Owners, National Highway Users Conference, and the Rubber Manufacturers Association, Inc.

New Personnel of Safety Council Automotive Group

The personnel of the executive committee of the automotive and machine shop section of the National Safety Council for the ensuing year includes the following men: general chairman, Merle C. Hale, General Motors Corp.; vice-chairman, C. T. Winegar, Dodge Brothers Div., Chrysler Corp.; vice-chairman, Elmer F. Harris, Mesta Machine Co., machine division; secretary, M. A. Clark, United States Rubber Co.; news letter editor, Robert Murphy, Motor Products Corp.; engineering committee chairman, G. E. Sanford, General

Electric Co.; health committee chairman, Dr. A. L. Brooks, Fisher Body, Detroit Div., General Motors Corp.; membership committee chairman, C. W. Bishop, Lycoming Manufacturing Co.; posters, slides and safety kinks committee chairman, Nelson Kiser, Studebaker Corp.; program committee chairman, Marvin A. Heidt, Budd Wheel Co.; publicity committee chairman, C. A. DeMonge, Kelsey-Hayes Wheel Corp.; statistics committee chairman, R. F. Thalner, Buick Motor Co., and members at large, L. E. Averill, C. H. Dockson Co.; C. M. Dotterer, Revere Copper and Brass, Inc.; H. L. Fracher, Detroit Steel Products Co.; M. J. McCarthy, Fisher Body, Detroit Division, General Motors Corp.; R. A. Shaw, The Murray Corp. of America; Carl L. Storck, Delco Products.

NRA Approves Trucking Industry's Labor Board

The National Recovery Administration has announced recognition of the temporary membership and the plan of procedure for the trucking industry's National Industrial Relations Board. The members are:

Allen W. Willson, Boston; William G. Fitzpatrick, Detroit, and S. J. Cashel, St. Louis, temporary industry representatives; Edward J. Tracy, of the NRA Labor Advisory Board; Fred Tobin and Thomas O'Brien, of the International Brotherhood of Teamsters and Chauffeurs Union, Washington, D. C., temporary employee representatives.

CALENDAR OF COMING EVENTS

SHOWS

Cleveland (Automotive Service Industries)	Nov. 19-23
New York Automobile Show	Jan. 5-12
Chicago Automobile Show	Jan. 26-Feb. 2
Automobile Merchants Assoc. of N. Y., Automobile Show	Jan. 5-12, 1935
Washington Automotive Assoc., Automobile Show	Jan. 12-19, 1935
Automobile Trade Assoc. of Maryland—Baltimore—Automobile Show	Jan. 19-26
Philadelphia Automobile Trade Assoc.—Automobile Show	Jan. 14-19
Boston Automobile Dealers Assoc.—Automobile Show	Jan. 19-26
Los Angeles Automobile Show	Jan. 5-13
Columbus, Ohio Automobile Show	Jan. 19-24
Kansas City, Mo. Automobile Show	Feb. 9-16
Denver, Colo. Automobile Show	Feb. 10-23
Evansville, Ind. Automobile Show	Feb. 23-27
Milwaukee Automobile Show	Jan. 12-19
Detroit Automobile Show	Jan. 12-19
San Francisco Automobile Show	Jan. 19-26
Minneapolis Automobile Show	Mar. 9-16
Mankato, Minn. Automobile Show	Mar. 16-23
Omaha Automobile Show	Feb. 3-9

MEETINGS

American Trucking Association, Chicago	Oct. 22-24
--	------------

ANNUAL MEETINGS

American Power Boat Association—Hotel Lexington—Annual	Oct. 25
Society of Automotive Engineers—Annual Meeting—Detroit	Jan. 14-18

Society of Automotive Engineers—Annual Banquet—New York	Jan. 7
Automotive Parts & Equipment Mfrs., Inc.—Annual Meeting—Chicago	Jan. 29
Natl. Automotive Parts Assoc., Detroit	Nov. 13-17
Motor & Equipment Manufacturers Assoc., Cleveland	Nov. 19-23
Natl. Standard Parts Assoc., Cleveland	Nov. 16-17
Motorcycle & Allied Trades Assoc., New York City	Jan. 9
American Engineering Council, Washington, D. C.	Jan. 10-12
American Roadbuilders Assoc., Washington, D. C.	Jan. 22-25

CONVENTIONS

Natl. Wholesale Hardware Assoc. Annual Convention—Atlantic City	Oct. 22-25
International Foundry Congress, Philadelphia	Oct. 22-26
American Foundrymen's Assoc., Philadelphia	Oct. 22-26
Motor & Equip. Wholesalers Assoc. Annual Convention—Cleveland, O.	Nov. 16-17
National Foreign Trade Council, New York	Oct. 31-Nov. 2

EXPOSITION

Natl. Exposition of Power & Mechanical Engineering (Biennial) New York, N. Y.	Dec. 3-8
---	----------

FOREIGN SHOWS

International Aeronautic Exposition, Paris, France	Nov. 16-Dec. 2
--	----------------

The Horizons of B

THE annual conclave of organized labor has yielded to the speakers' final gavel. The delegates have returned to their jobs. It is not necessary here to break these jobs into detail but merely to say that the general purpose of organized labor today, as in the past, is to promote the best long-time interests of the worker. Detached and sympathetic observers are asking if labor is now pursuing a policy of intelligent selfishness.

In Terms of Public Interest

Consider the demand for a 30 hour week and a rise in wages sufficient to maintain the contents of the 40 or 44 hour pay envelope. In urging this demand labor is copying the tactics of every group which has ever pressed its interest on the public stage. Instead of admitting frankly and more accurately that the worker wishes to increase his share of the national income, that he is striving to improve his position in terms of material return, his articulate emissaries admonish the world that all their efforts are directed toward the public good.

Thus the plea for a 30 hour week is not a narrow effort to capitalize the current bargaining advantages of labor, but merely an attempt to promote the general weal. If the hours of labor are cut, more workers will be needed to fill available jobs, thereby reducing unemployment and relieving federal and local government treasuries of relief burdens. If the wages of the worker are raised he will have more money to spend. This will increase the demand for goods, re-open idle plants and convert the country side once more into a busy productive scene.

The Philosophic Base of Labor's Case

Labor rests its case upon what

we may term the spread-work theory of employment and the stimulated-consumer-power theory of prosperity. These two constitute the philosophic base upon which the case of labor rests. In exaggerated simplicity these theories have poured from the lips of labor officials, public servants and some economists with such frequency and emphasis that they have become inexorable axioms which need but be stated to establish their irrefutable validity.

It is difficult to separate the spread-work idea from the stimulated-consumer-power idea because the specific fields where work is scarce are already suffering (or benefiting) from excessive stimulus to consumption in the form of high wages. As illustrations we will mention anthracite mining, construction, and tool and die making in the automobile industry. However, if it is maintained that the human energy available to the community is so abundant that it must be subjected to artificial restraints such as the 30-hour week then we are claiming that we have reached a stage in productive efficiency where the community cannot consume all that it produces. The depression with its attendant idle plant capacity has made it easy to accept the view that the country has too much productive energy. This conclusion does not stand up when we examine it more carefully.

The Longer Week in 1929

In the spring of 1930 the U. S. Census of Employment showed a little less than 49 million workers gainfully employed. This accounted for 39.8 per cent of the population as compared with 32.4 per cent in 1870. That part of the population able and willing to work was fully employed at the time. The average work week was

51 hours. Did this full employment at an average 51-hour week produce a stream of goods and services which the country could not consume?

In the year 1929 there were 11,653,000 families with incomes ranging from zero to \$1,500. This 40.6 per cent of the population did not have as much food as it desired or the housing, furniture, clothes, recreation and medical attention to which an American citizen has the right to aspire.

The answer is that 49,000,000 men and women working 51 hours a week aided by the finest physical equipment, the richest natural resources and the ablest management which any nation has ever had did not produce as much as this country could have consumed. The American Federation of Labor now insists that the public interest can best be served by a 30-hour week. The general application of a 30-hour week will depress living standards and turn back the hands of economic progress 35 years. Although sophistry may win an argument it cannot provide bread. The most ingenious polemics cannot make the efforts of 30 hours equal the efforts of 51 hours or satisfy wants which even a 51 hour week could not satisfy.

Worker Becomes Victim of a Theory

The theory of stimulated consumption via higher wages has probably caused more confusion and mischief than any theory which ever gained currency. Unfortunately it is seriously injuring the workingman, the very individual on whose behalf it is most unreasoningly urged. The theory, briefly, is that the worker and consumer are identical, that the employer, investors and producers of materials are not consumers, therefore that any increase in consumption is possible

Business

by Joseph Stagg Lawrence

only through an increase in wages. Consider this theory first in its crudest form, i.e., that the worker is the only producer and the only consumer. If we raise wages from one to two dollars an hour, it follows that the cost of the gadget which the worker produces is doubled. Now if the worker is the sole consumer, with prices doubled, his pay envelope, now containing twice as many dollars as it did before the raise, buys precisely the same number of gadgets. More counters, i.e., money, will be used but certainly there will be no increase either in production or consumption.

The Marxian Refinement

Consider the next refinement of this theory, namely, that the wage earner is the only effective consumer, that a failure to pay out in wages an amount equal to the value of the gross product creates a deficiency in consuming power. This is aggravated by management which retains a part of the gross return and immediately invests it in additional plant capacity. Still more gadgets are produced thus increasing the deficiency in consuming power and the surplus of consumable products until finally we have another collapse, i.e., depression.

We could be malicious at this point and take the case of the contractor who specialized in private and public monuments, supported a musical foundation with part of his profits and left his accumulated fortune for research in cancer. Just what part of the finished product did this man's workers consume? How did the portion which he retained increase productive capacity or aggravate the surplus (?) of monuments. Time and space here prevent the fuller development of this idea, but any reader can try to fit this con-

sumer - worker-purchasing - power theory to the case of Andrew Carnegie.

Instead of taking the case of a capital goods industry where this theory encounters insuperable obstacles from the very beginning, consider the automobile industry. According to the census of 1933 every dollar received by the producers was apportioned approximately as follows; to the worker 20 cents, to the 'producer of materials 58 cents and to a miscellaneous group of claimants including the stockholders 22 cents. Among the latter we must note the governments to which the industry pays taxes. The A. F. of L. espoused wage theory would indicate that only the worker who receives one-fifth of the gross income is an effective consuming agent. This of course immediately raises the question of what is done by the producers of materials who account for 58 cents of the automobile dollar. Does the city of Detroit which participates substantially in the 22 cent balance take its share and bury it or does it pass into the channels of consumption just as effectively as do the contents of the workers' envelopes? Do stockholders subsist on a straight diet of ozone? Do they wear nothing but that frown of guilt which, according to the labor theory of consumption, they should wear because their receipt of dividends, if and when, impairs buying power?

In this connection we can only mention that a large part of the surplus which the companies retain as well as the dividends paid out to stockholders are used to promote new enterprises, to subsidize experimentation and technological progress. All of which ultimately raises the standard of living and gives employment in what we shall call the capital goods industries; precisely the

field suffering most from the depression. The food processors and distributors are doing almost as well as they did in 1929. Steel, since the end of June, has been operating at less than 25 per cent of capacity. From the point of view of recovery which requires stimulus, the industries supported directly by the expenditures of workingmen's wages or those whose activity depends upon capital courage and capital accumulation?

An Arrested Philosophy

Public policy, the efforts of labor and management should be directed toward two broad objectives. The first and immediate purpose is recovery. The continuing long time objective should be the progressive elevation of standards of living. The fault of labor's philosophy is that it is an arrested philosophy. It stops before the reasoning process is complete. Our productive energies are roughly divided into two fields. In the first we provide for our current needs, i.e., food, clothing, recreation. In the second for the future, construction, technological progress. The depression analyzes largely as a collapse in this second field. Here is where help—possibly just greater freedom from labor and governmental strangulation is necessary. The long term objective, a higher standard of living, is possible only through longer hours of work than the A. F. of L program permits. Management is as eager to promote recovery and better living standards as organized labor and the government. Management believes that government policy and labor power are headed in the wrong direction.

Next week we will examine the effect of labor's program on employment.

Tolerances in Automotive Parts

ONE important problem in automobile design concerning which comparatively little has appeared in the technical press so far is that of tolerances. True, general statements are often published to the effect that in the manufacture of this or that car, parts are held to the thousandth part of an inch or closer, but such statements are of little help to the designer who has to fix the tolerances for the different parts. It is also true that there are standard tables of allowances and tolerances covering different kinds and grades of fits, but the selection of the proper values from these tables is not an easy matter, requiring judgment and experience.

Automotive Industries has recently collected data on tolerances on the more important wearing parts of practically all current models of American passenger cars. Tables of the limiting dimensions of these parts and of the tolerances represented by them will be published in the Production Number to be issued next week. These tables accurately reflect current American practice.

Contrary to what might be expected, the tolerances do not always vary in inverse order as the price. Of course, in the case of certain parts which are selectively fitted, such as the pistons in the cylinders, the tolerances allowed in production are no index of the class of fit obtained in the finished vehicle. But where parts are assembled as they come, the grade of fit will vary with the tolerances adhered to in production.

The writer has made an analysis of the tables prepared, and in the following will briefly discuss the data.

Ordinarily, of course, where a wide range of sizes of similar parts is involved, tolerances would vary with the basic size, for the same class of fit. But the range of cylinder bores covered by the data extends only from just under 3 in. to 3½ in., so that differences in bore can be neglected.

It is found that in the majority of

the engines a tolerance of 0.002 in. is allowed on the cylinder bore; that is, the maximum dimension for the bore is 0.002 in. greater than the minimum. There is considerable variation with respect to the distribution of the tolerance on opposite sides of the nominal value of the bore. In fact, every possible case is represented; that is, the plus tolerance may be zero and the whole tolerance negative; the minus tolerance may be zero and the whole tolerance positive; the tolerance may be equally divided on both sides of the nominal value, or it may be unequally divided, and in the latter case either the positive or the negative tolerance may be the larger.

In most engines the total tolerance on the cylinder bore amounts to 0.002 in. This is also the tolerance on the piston skirts of the majority of engines. If we deduct the lower limit on the skirt diameter from the upper limit on the bore we get the maximum possible clearance, and if we deduct the upper limit on the skirt diameter from the lower limit on the bore we get the minimum possible clearance. The latter operation in some cases gives a negative value; that is, the maximum skirt diameter is greater than the minimum bore, which would give an interference fit instead of a running fit. This is explained by the fact that selective assembly is used and pistons of maximum "passable" size are never fitted into bores of minimum "passable" size.

As an example of how the selective method of assembly is practiced, assume that the limits on a given piston diameter are 3.125 and 3.127 in. Let us assume that the gage used for measuring the diameter reads to one-ten-

thousandth. Then the pistons which are passed by the inspector may be graded as follows: 3.1250, A; 3.1255, B; 3.1260, C; 3.1265, D; 3.1270, E. These letters are stamped on, or else the pistons of the different size classes are given distinctive color markings.

The minimum number of groups used by any manufacturer is four and the maximum 12. In the case of the models for which pistons are divided into 12 groups, the total tolerance is only 0.004 or 0.0042 in. so that if the limits for all groups are equally spaced, the tolerance in each group is only a little more than 0.0003 in. and all fits therefore can be very closely alike.

Maximum allowances, when averaged, give a value of 0.0037 and minimum allowances and interferences when averaged give a value of 0.0001 interference. The value aimed at by selective assembly is evidently the mean of these two, viz., 0.0018 in. allowance, or a radial clearance of 0.0009 in. This is very close to 0.001 in., so that it is very close to the truth to say that the prevailing practice in passenger car engines is to specify a tolerance of 0.002 in. on the cylinder bore and a tolerance of 0.002 on the diameter of the piston skirt, and to aim at a mean diametral clearance of 0.002 in. by selective assembly.

An interesting observation made in connection with piston clearances is that while in the majority of engines the difference between the minimum bore and minimum skirt diameter is the same as the difference between the maximum bore and the maximum skirt diameter, in a number of engines these differences vary, the difference between minimum dimensions being considerably greater. Just what the theory be-

by P. M. Heldt

Engineering Editor, *Automotive Industries*

Production

hind this method of setting tolerances may be is difficult to say. The average difference between minimum bore and minimum skirt diameter is 0.0021 in. and the average difference between maximum bore and maximum skirt diameter 0.0017 in., the mean of which is 0.0019 in. This confirms the statement made above that the diametral clearance aimed at in most cases is about 0.002 in.

In many cases the pistons are fitted to cylinders selectively by means of feeler gages. These gages, as a rule, are 1 in. wide and of a thickness equal to the diametral clearance wanted. Where this method is used the pull which must be exerted on the feeler to move it is specified. In some cases the pull is specified as 2-4 lb., in others as 10-20 lb. Then, again, the requirement may be that a 0.002-in. feeler allows the piston to slide while a 0.003-in. feeler locks it.

More than half of all engines for which data were obtained on this particular item have a tolerance of 0.001 in. on the main journals, the remainder having tolerances of either 0.0005 in. or 0.002 in. Tolerances on internal diameters of main-bearing bushings run very much the same as those on journals, the majority being 0.001 in., while there are also tolerances of 0.0005 in. and 0.002 in., with one of 0.00025 in. Clearances between main journals of maximum diameter and bushings of minimum bore vary from zero to 0.002 in., the average being 0.0011 in., and clearances between main journals of minimum diameter and bores of maximum diameter vary from 0.0015 to 0.0045 in., the average being 0.0033 in. The mean of these two values is 0.0022 in.

The minimum—or very close to the minimum—clearance provided for by the limit specification is probably the most desirable, and greater clearances are permitted only because it is commercially impossible to make all parts exactly alike. Summarizing the main-bearing data—in most cases tolerances of .001 in. are allowed on both the journal and the inside diameter of the bushing, and the limits on the bushing diameter and the journal diameter are

so set that the diametral clearance will average 0.0022 in.

The tolerance on the front bearing of the camshaft is 0.001 in. in the greatest number of models, but an almost equal number have a tolerance of only 0.0005 in.; one has an intermediate tolerance of 0.0007 in., and one the exceptionally large tolerance of 0.0055 in. On the bore of the bushing for the camshaft front bearing, considerably more than half of all the models have a tolerance of 0.001 in. The tolerance on this same dimension for other engines varies all the way from 0.0003 to 0.003 in. There is a wide variation in clearances for this bearing. The minimum clearance provided for varies from 0.0005 to 0.0048 in. and averages 0.00143 in., while the maximum clearance varies from 0.0020 to 0.065 in. and averages .0035 in. The mean of these two averages is practically 0.0025 in.

Maximum and minimum clearances for camshaft front bearings average up substantially the same for engines with gear drive and chain drive. One would expect a close fit at this point to be most important in the case of gear drive, and, as a matter of fact, the lowest mean clearance is found in an engine with gear drive. However, it would

seem that engineering departments sometimes continue the same practice with regard to bearing clearance when changing from one drive to the other. Thus one maker who used gear drive for many years past and changed to chain drive recently retains the same close clearances on the camshaft front bearing which were used by him in the past, while another who has used chain drive in the past and changed to gear drive some time ago uses comparatively large clearances. The mean clearance in the former case (for chain drive) is 0.0015 in., while the mean clearance in the latter case (for gear drive) is 0.0042 in.

Front-bearing bushings for the camshaft are frequently inspected by means of single ring gages, a push fit being specified for a ring gage of specified diameter. In other cases press fits in the bore of the crankcase are specified. One engine has two bearings at the forward end of the camshaft, one to take the load and the other for the introduction of lubricant into the camshaft. The former naturally must have the smaller clearance.

Where valve inserts are used the tolerance on the outside diameter is 0.001 in. These inserts are a shrink fit in the cylinder block and the interference allowed ranges from 0.0035 to 0.0050 in. On the counter bore in the block the tolerance is held to 0.0005 in.

Valve stem diameters in nearly all

NEXT WEEK in its Annual Production Issue Automotive Industries will present one of the most comprehensive surveys of tolerances in current American passenger cars that has ever been made. This article summarizes the data and draws some general conclusions from them.

cases are held to tolerances of 0.001 in. though one manufacturer goes to 0.002 in. on the exhaust-valve stem and two drop to 0.0005 on both the inlet and exhaust-valve stems. The tolerance on valve-guide bores also is 0.001 in the majority of cases. Where it differs from this value it is larger, up to 0.002 in. The clearance between inlet valve stems and guides ranges from an absolute minimum of 0.0005 to an absolute maximum of 0.005 in. A very popular clearance range is from 0.001 to 0.003 in. and these figures are also very close to the averages of all minimum and maximum clearances.

There is wide variation in respect to exhaust-valve-stem clearance. Minimum clearances allowed for vary from as low as 0.0005 in. to as high as 0.0045 in., while maximum clearances vary from 0.0013 to 0.060 in. A good average clearance range is .002-0.004 in. Thus the exhaust-valve stem is given more clearance in its guide than the inlet-valve stem, which is necessary because it reaches a higher temperature than its guide and also because it cannot be lubricated as effectively as the inlet valve stem.

Tolerances on bores for valve-stem guides and on the outside diameters of the guides are generally 0.001 in., this being the value for the bore in 16 out of 23 cases and for the guide in 14 out of 23 cases. The valve guides are a force fit in the bores for them, the interference generally ranging from 0.0005 to 0.0025 in. Taking all of the data at hand, the absolute minimum interference provided for is zero and absolute maximum, 0.004 in.

It is well known that the piston pin fit is one of the most important in the whole engine, hence the tolerances on both the pin and the hole for it must be very close. Tolerances on piston-pin diameters range from 0.0002 to 0.001 in., the average being about 0.00035 in. Tolerances on the bore for the piston pin also range from a minimum of 0.0002 to a maximum of 0.001 in. but the average is slightly larger than in the case of the pin—about 0.00045. In the majority of cases the piston pins are assembled to the pistons selectively. Where they are not thus assembled the fit varies from

0.0004 in. interference to 0.0002 clearance.

Tolerances on the bore of the bushing in the upper end of the connecting rod average 0.0005 in.

In the case of the bore of the upper end of the connecting rod the tolerance varies somewhat according to whether this end is bushed for the piston pin or the piston pin is clamped in it. If the piston pin is clamped in the rod, the latter is usually split, and in that case a close tolerance is not essential. In one case where this construction is used, the tolerance is 0.003 in. In the majority of cases (25 in all), the tolerance is 0.001 in.; in others, it is either 0.0015 or 0.002 in.

The bushing, of course, is a press fit in the upper end of the connecting rod and its outside diameter therefore exceeds the bore into which it is fitted. Data on the actual interference allowed could be obtained only in few cases. The interference of this fit varies all the way from an absolute minimum of 0.0005 in. to an absolute maximum of 0.0055 in.; the usual range is from 0.0025 to 0.0045 in.

The tolerance on the width of piston rings—both oil and compression—is 0.0005 in. Tolerances on ring-groove widths vary from 0.0005 to 0.001 in., the latter being the most common. The clearance of the rings in the piston grooves generally has a minimum value of 0.001 and a maximum of 0.0025 in. if interchangeable assembly is practised, but in some cases the rings are assembled selectively.

Crankpin Tolerance

On the crankpin diameter there is a tolerance of 0.001 in. in about 80 per cent of all engines. Of the remainder, some have a tolerance of 0.0005 in. and some of 0.002 in. on this dimension. Where thin-wall bearings are used and the wall thickness is specified, the tolerance on this dimension is usually 0.00025 in., but in one case it is 0.001 in. and in another, 0.0015 in. With such tolerances as these latter, combined with tolerances on both the big-end bore and the crankpin, selective assembly is essential, of course.

Tolerances on the bore of the connecting-rod lower end vary between 0.0003 in. and 0.0012 in. In the majority of cases they are either 0.0005 or 0.001 in. There is a difference, of course, whether the rod is babbitted or thin-walled steel-backed bearings are used. In the former case the tolerance referred to is that on the bore of the babbitt-lined rod, while in the latter it is the tolerance on the bore of the rod itself. With a babbitt-lined rod the maximum diametral clearance between crankpin and bearing evidently

will be equal to the difference between the maximum bore and the minimum pin diameter, while the minimum clearance will be equal to the difference between the minimum bore and the maximum pin diameter. But if a thin-walled bushing is used, the maximum clearance will be obtained by subtracting from the maximum bore twice the minimum thickness of the bushing and from this the minimum crankpin diameter, while the minimum clearance is obtained by subtracting from the minimum bore twice the maximum thickness of the liner and the maximum pin diameter. It is here assumed that assembly is not selective. It might, therefore, be expected that the tolerances would be closest on the bores of rods fitted with liners, but actually the closest tolerance (0.0003 in.) occurs in a babbitted rod. In the case of the babbitted rods the minimum diametral clearance averages close to 0.001 in. and the maximum 0.003 in. In one engine the "burning in" process seems to be employed as the fit varies from 0.007 in. interference to 0.0007 in. clearance.

The tolerance on the center-to-center length averages a little over 0.005 in. The most "popular" tolerance on this dimension is 0.004 in.

The most widely used tolerance on both the flywheel outside diameter at the ring-gear seat and of the inside diameter of the ring gear when cold is 0.004 in. This is also very close to the average tolerance for all flywheels. As regards the ring gear tolerance, while 0.004 in. is used in most cases, the average value of all tolerances on this dimension is a little over 0.005 in. The ring gear, of course, is a shrink fit. In a great many cases the interference ranges between 0.016 and 0.024 in. but the averages of the minimum and maximum interferences are 0.013 and 0.021 in. In a shrink fit the interference, of course, should vary with the diameter, but the diameters of all ring-gear seats range between 12 and 14 in., so that it is permissible to neglect this factor. In some of the more powerful engines the ring gears are fitted selectively and tested for ability to withstand driving torque. It is interesting to note in this connection that only one make of engine among those listed retains the integral starter gear.

Tolerances on outside diameters of splined shafts vary widely—from 0.0005 in. to 0.0120 in. or in the ratio of 24 to 1. The explanation undoubtedly is that in some transmissions the sliding gear is piloted by the tops of the shaft splines, in which case the shaft diameter over the splines is very important, while in other cases the gear is carried on the bottoms of the spline grooves, in which case there is no particular need for a high degree of accuracy of the diameter over the shaft splines. Fourteen of the models for which data were gathered had a tolerance of either 0.0005 or 0.001 in. on the diameter over the splines, and in these the gear evidently is carried on

(Turn to page 484 please)

JUST AMONG OURSELVES

Clean-Up Threatens To Open Old Sores

THAT perennial cause of friction between factories and dealers, the annual clean-up, bids fair to create more than usual bitterness this year. Perhaps this is due largely to the fact that the industry is having its first experience with the rules governing clearances laid down in the dealer code.

Some irritation over the losses the clean-up entails probably always will be with us since it is doubtful that production scheduling will ever be perfected to the point that the output of a given series will exactly equal the number of cars that can be sold at full prices. However the destructive effect the operation can have on trade morale, makes it imperative that every effort be made to minimize discord. This is particularly so since the clean-up is succeeded immediately by the introduction of new models at which time dealer enthusiasm and loyalty are vitally important and factories go to great lengths to stimulate such feelings.

What is needed are some definite rules on which agreement can be obtained between factories and dealers. Whether these should be on an industry-wide basis or established by each factory to fit its own conditions, is debatable. But that the adoption of clear-cut policies under which every one would know his exact position, would improve the present situation when opportunism and expediency sometimes control, can hardly be questioned.

* * *

IN connection with last week's discussion of Jesse Jones' statement that "Interstate highway traffic should be taxed on a plane with the railroads," the following data seem interesting:

1933 Special motor vehicle taxes, \$1,137,872,176.

1933 Truck license fees and gas taxes, \$224,029,445.

1933 Total railway tax bill, \$268,000,000.

* * *

Will Houde Get Its Blue Eagle Back?

NOW that the Attorney-General has decided that there is no case against Houde that would stand up in court, will the Buffalo parts company gets its Blue Eagle back?

Or will NRA refuse to return the bird as it did in the Harri-man case when the Department of Justice made a similar decision that the evidence did not justify prosecution?

Certainly the manner in which the government has used the combination of its purchasing power and the Blue Eagle to force compliance with the rulings of administrative agencies before they had been upheld in court, has few, if any, parallels in our history.

No accusation that the Ford Motor Co. was not complying with the automobile manufacturing code or the law was ever sustained even by an administrative body. Yet because it did not assent to the code, something the Recovery Act does not require it to do, the administration refuses to buy Ford cars.

In the Houde and Guide cases, so long as the present policy persists, their products may not be furnished on government orders although no court has passed on their respective cases. Numerous car dealers have been punished similarly without judicial determination of the cases.

Regardless of the merits of these cases, every man is entitled to his day in court. Through the device of the Blue Eagle, this right has been nullified—admin-

istrative agencies have usurped the exclusive right of the court to deal penally with those accused of violating the law.

Reports from Washington indicate that the Blue Eagle may be one of the first appendages of NRA to be lopped off. It is to be hoped that these reports are true and that with the Eagle will go the policy of boycotting bids of government suppliers who for one reason or another at present do not fly the famous bird.

* * *

AFL Decision Removes Jurisdictional Threat

THERE is some comfort for automotive employers in the A. F. of L. decision that it will seek to organize mass production industries on a vertical rather than on the traditional craft basis. If the Federation sticks to this policy and is successful in its organization efforts, it means at least that automotive employers will not be plagued with jurisdictional strikes while battling unions determine whether radiators are to be installed by plumbers or pipefitters.

On the other hand, due to the nature of mass production, there is no doubt that the Federation has made its job less difficult by adoption of the vertical policy as splitting the industry's workers into crafts would seem to offer almost insuperable difficulties. The "one big union" idea, if successful, also should make for greater solidarity among the workers but that this will make the strike weapon a more effective threat doesn't necessarily follow since the walkout of the members of a craft union in a key department can tie up operations in an entire plant.

The vertical union decision apparently indicates also that the Federation looks forward to the day when it can secure some sort of industry-wide contract such as it sought and failed to obtain in the recent cotton textile strike. Of course, before the Federation can seriously make any such proposal, it has plenty of spade work to do as it has yet to demonstrate that it can organize automotive workers into vertical, craft or any other kind of union.

—The Editors

PARIS SHOW——

Discloses Advancements in Springing and a Greater N



Three - quarter front
view of new Renault
car

WITH 56 exhibitors in the passenger car section, the Paris Automobile Salon has shrunk 35 per cent in four years. France heads the list of exhibitors with 26 makes, America following with 10, the others in order of importance being Germany 8, England 6, Italy 4, Belgium 1, and Czecho-Slovakia 1. The American makes having booths in the hall are Chrysler, De Soto, Dodge, Graham, Ford, Hupp, Lincoln, Packard, Plymouth, and Studebaker. A truck show is held concurrently with the passenger-car exhibition, most of the commercial vehicles being in the basement. The show management has also staged a valuable historic exhibition, which includes Cugnot's steamer built in 1770, and the first models produced by such firms as Panhard & Levasor, Renault, De Dion, Leon Bollée, Hotchkiss and Chenard Walcker. Only French vehicles are shown.

The opening of the show was marked by the announcement of the formation of the 20,000,000 francs Matford Company, uniting Mathis and Ford in one organization. The board consists of E. E. C. Mathis, Edsel B. Ford, J. C. Charpentier, Maurice Boyer, and Maurice Dollfus. The two makes will retain their identity, but they will have the same commercial, financial and technical

organizations and many parts will be interchangeable on Mathis and Ford models.

At the present time 18 American engineers are supervising the installation at Strasbourg of machinery duplicating that at River Rouge for the production of Ford V-eight engines. The Mathis plant at Strasbourg is being enlarged. The plant at Gennevilliers, near Paris, will be closed. The Ford plant at Asnières, near Paris, will be continued. One

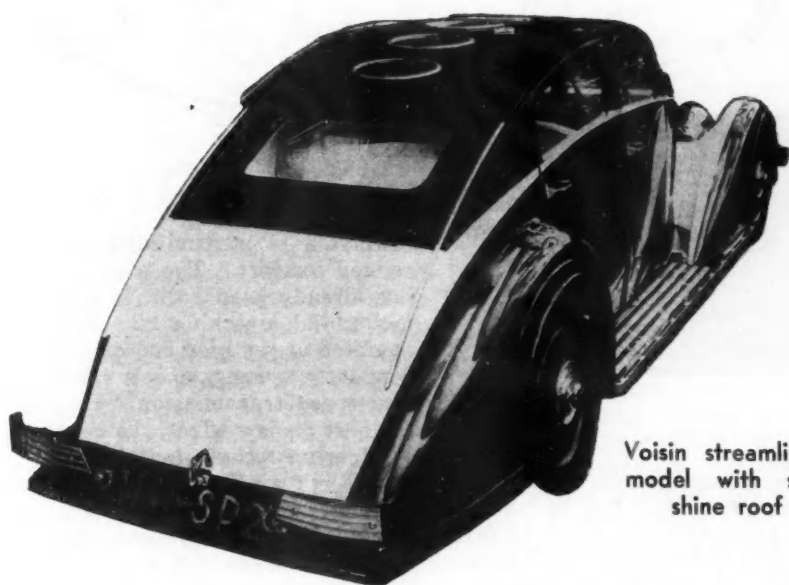
of the first technical changes is the production of a Mathis model with the Ford V-eight engine. This engine will be built at Strasbourg for both Ford and Mathis. The Ford four cylinder job will be continued; probably the small Ford will be dropped in favor of the smaller Mathis models. A truck program is being developed. Up to the present no changes have been announced in the Fords. Mathis continues torsion bar suspension on most models.



Three-quarter rear view of the Renault

by W. F. Bradley
Paris Correspondent, Automotive Industries

in Streamlining and Independent Number of Models with Front Drive



Voisin streamlined
model with sun-
shine roof

attained with the small Citroen which could not be secured with the more conventional type of automobile.

The two new Citroen models differ from the original type more in dimensions than in design. The body width is practically equal to the track of the car, thus accommodating three passengers abreast. The body design is the same and the same torsion bar suspension is used. Many of the parts of the 22 h.p. eight-cylinder engine are interchangeable with those of the 11 h.p. four. For the first time an overhead valve engine, with pushrod and rocker operation, is being used. Citroen is offering all his models

This show is the first one held in France since the horsepower tax was dropped in favor of a straight tax on gasoline. The result is seen in the great attention given to economy, bringing as a consequence streamlining, weight reduction and independent suspension. The move towards streamlining is so pronounced that it appears likely to revolutionize chassis design within a very short time. Last May Citroen produced a 7 h.p. front driver with a one-piece metal body, in the design and building of which the Budd Company played an important role. At this show he has added an 11 h.p. four cylinder model and a V-eight of the same bore and stroke as the four. All three models are front drivers with the Budd one-piece body. Despite the bitter criticism of rivals, the front-drive Citroen has met with wonderful commercial success and the design has impressed engineers and focussed attention on streamlining. It is admitted that because of the low weight and diminished head resistance, results have been

At the Paris Show Was Seen—

Rear engine mountings:

Tatra, air-cooled eight
Mercedes-Benz, water cooled four

Front drives:

Citroen, fours and eights
Chenard & Walcker, four-cylinder
Derby, four and V-eight
Rosengart, four-cylinder
Audi, four-cylinder
D.K.W., 2-cylinder two-stroke

Independent springing (front and rear):

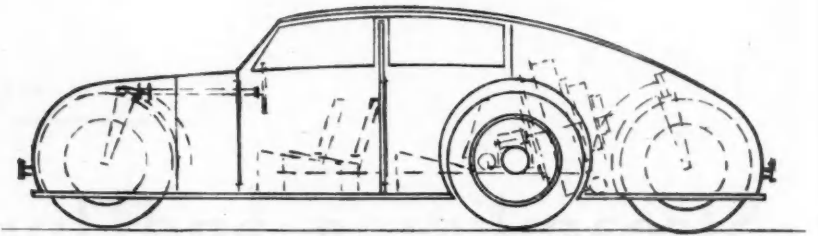
Citroen (torsion bars)
Mathis (torsion bars)
Chenard & Walcker (torsion bars)
Mercedes-Benz (coil and leaf springs)
Delaunay Belleville (coil and leaf springs)

Tatra (leaf springs)
Rosengart (leaf springs)
Adler (leaf springs)
Derby (leaf springs)
D.K.W. (leaf springs)
Audi (leaf springs)

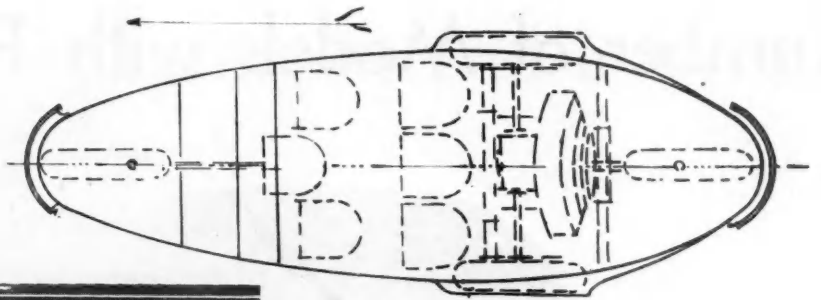
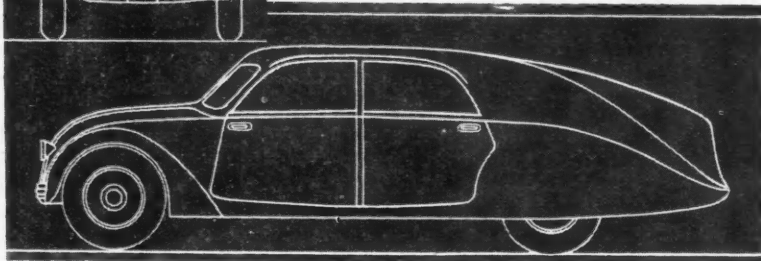
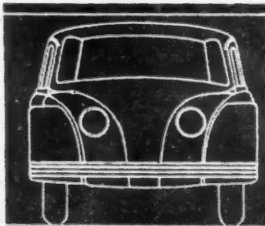
Independent springing (front only):

Delage (transverse leaf spring)
Delahaye (transverse leaf spring)
Talbot (transverse leaf spring)
Peugeot (transverse leaf spring)
Donnet (transverse leaf spring)
Berliet (transverse leaf spring)
Salmson (transverse leaf spring)
Unic (two semi-elliptic springs)
Lancia (coil springs and hydraulic)
Adler (two transverse leaf springs)
Amilcar (transverse leaf spring)

Right—Radical design by Voisin with radial engine at rear and front and rear steering wheels



Below—Front and side elevations of Tatra streamlined model with fin at rear



with wireless equipment at an extra charge.

In addition to Mathis, who was the first to adopt torsion bar suspension, it is now being used by Chenard & Walcker on a new front-drive job.

There is infinite variety in what are termed aerodynamic bodies. The most extreme example is presented by Tatra, with an aircooled V-eight mounted at the rear and driving independently sprung wheels. With a comparatively low speed engine of 183 cu. in., it is claimed that a speed of 90 m.p.h. is attained with four passengers aboard, the car weighing 3580 lb. empty and the gasoline consumption being at the rate of one American gallon per 27 miles.

The front wheels are steerers and are independently sprung by means of a transverse leaf spring and a parallelogram. Two spare wheels, battery, gasoline tank and tools are mounted in the space between the steering wheels. A full-width platform-type of body is used and the entire power plant is attached to this at three points. It is possible to disconnect the entire unit and remove it on its own wheels.

The body width being equal to the track, three passengers are carried abreast. Between the passengers and the engine there is a spacious

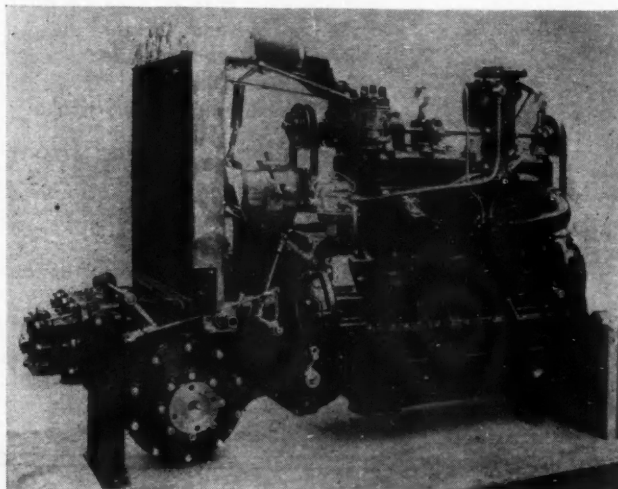
baggage compartment. The rear panel covering the tail of the car has its forward edge raised to form an air scoop, while the air is evacuated by two belt driven blowers—one for each bank of cylinders. Just below the scoop there are two oil radiators, for lubrication is of the dry sump type. The rear wheels are enclosed, but access to them is by means of a quick detachable flap.

Gabriel Voisin, one of the most advanced of French designers, announces that he is preparing a car in which chassis design has been sub-

ordinated to streamlining and passenger comfort. The engine, which has already been built, is a 7-cylinder radial weighing 225 lb. It is mounted at the rear and drives independently sprung wheels through a four-speed transmission. To obtain the best airflow effect, the usual pair of steering wheels in front are replaced by a single wheel in front and a single wheel at the rear, both steerers. This increased the total length of the car, but it gives a very short turning radius and allows the wheels to be enclosed in the streamlined body.

With an engine developing 150 hp. Voisin claims a speed of 120 m.p.h., a total weight of 2640 lb., and a gasoline mileage of 25 to the gallon.

There is not an automobile in the show which has not been modified to give at least the illusion of stream-



Chenard & Walcker four-cylinder front-drive power unit

lining. Renault has merged fenders and hood, with the headlights recessed in the former, has carried the body out to the full width of the chassis, and has placed the spare wheel in the tail, below the baggage compartment.

Peugeot, adopting the same body line for all four models, separates hood and bonnet, but gradually increases the width of the body, until it is equal to the track at the rear. The luggage compartment is a part of the body and the spare wheel recesses into a well on the sloping tail of the car. Registration plates are flush in the rear body panel.

Several makers have pushed the engine forward in the chassis, until the radiator is several inches ahead of the front axle. Renault and Hotchkiss have followed this plan, and in the case of the latter the same bodies are fitted on the four cylinder as on the six cylinder types.

There is a revival of interest in the convertible body, but the conversion is by power and not by hand. Peugeot has one model with a disappearing top, operated by an electric motor. Alfa Romeo shows a cabriolet by Farina which can be opened or closed by means of an electric motor controlled from the driver's seat. Kelsch, one of the French body builders, has a somewhat similar device. Voisin has a one-piece metal roof mounted on rails which can be moved backwards and forwards by means of engine vacuum. The desire for low bodies has favored the use of sponge rubber and pneumatic upholstery.

The only two rear engine cars in the show are the eight-cylinder Tatra and the four-cylinder, water-cooled Mercedes-Benz, this latter mounted in a wishbone chassis. The seven front drivers are Citroen, Chenard

A look into the engine compartment of the Tatra rear-engined car



& Walcker, Derby, D.K.W., Rosengart, Audi and Tracfort.

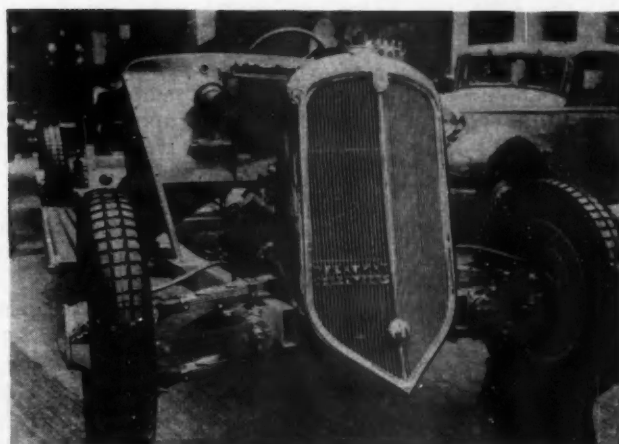
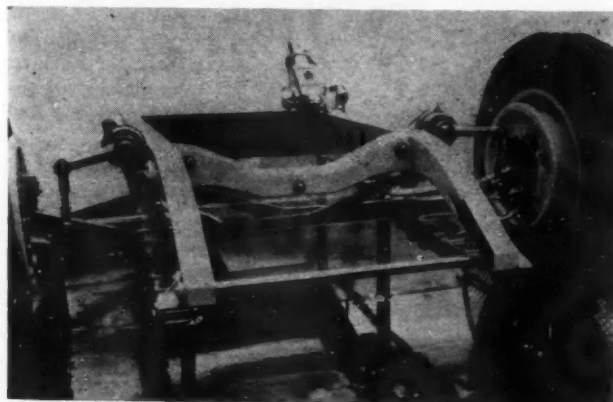
There are 22 European makes with independent wheel suspension, half of these having independent springing all round and 11 having knee action in front and a conventional axle at the rear. Torsion bars are used by three makers. Coil springs with a parallelogram attachment are used by Mercedes-Benz and also by Delaunay-Belleville under license. The type having the greatest number of supporters is a single transverse spring in conjunction with a parallelogram. Unic shows a type with normal semi-elliptic springs and a couple of three-quarter length axles, the inner end of each axle being shackled to the outside of the frame member opposite that on which the spring is carried.

The Dubonnet suspension is not

shown, but contracts have been signed recently for its use on one leading make of car in Italy, one in France, and three in England. These models are expected to be put on the market next spring. Dubonnet has improved his suspension by securing automatically variable flexibility, the spring yielding readily near the neutral point and becoming stiffer as compression increases.

While there is an increasing number of synchromesh gears, the only new feature in this line is the redesigned Cotal planetary gear with electro-magnet control. In its present form the Cotal transmission occupies less space than the conventional type of gear. It is being used by Salmson, Chenard-Walcker and Unic, and also on the Voisin car as a relay, thus providing six speeds with a three-speed transmission.

Unic independent front suspension with two axle units swiveled to far side of chassis frame



Front independent suspension on Delaunay-Belleville

Federal Mogul Tests Efficacy of C

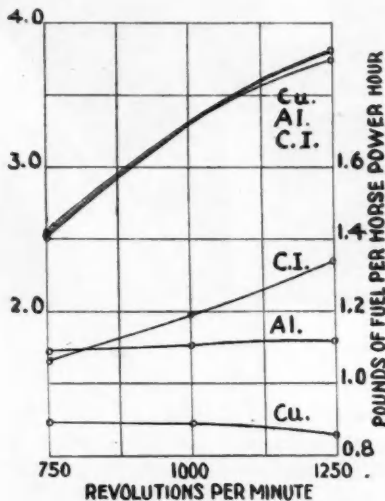


Fig. 1—Horse power and fuel-consumption as affected by cylinder-head material

(The three upper substantially coincidental curves represent horse powers to the scale at the left)

FOLLOWING the completion of exhaustive investigations and tests, the Federal-Mogul Corporation of Detroit has decided to enter the cylinder-head field with heads based on the use of copper and copper alloys. This research work was started some time ago by Federal Mogul in the belief that the relatively high thermal conductivity of copper and its alloys might tend to minimize the formation of local hot spots, and thus might prove superior to other materials for internal combustion engine heads.

A program was laid out and a group of experiments was arranged for at the Battelle Memorial Institute, Columbus, Ohio, under the direction of Dr. H. W. Gillett, chief technical advisor and formerly of the Bureau of Standards, and sponsored jointly by Federal-Mogul and Calumet and Hecla Consolidated Copper Company.

The early work consisted in experiments on a single cylinder engine, equipped with cylinder heads of various materials and compression ratios. Primarily it was sought to establish whether or not copper alloy heads had any superiority or deficiencies as compared with heads of other materials irrespective of combustion chamber shape and compression ratio.

The results of this work are illustrated in Chart 1, showing checks on copper alloy, aluminum and cast-

iron heads of equal compression ratios and same chamber shape. The object here was to determine fuel consumption with regular gasoline with the engine adjusted in each case for maximum power at full throttle. (Carburetor and spark settings just below detonation point for each head.)

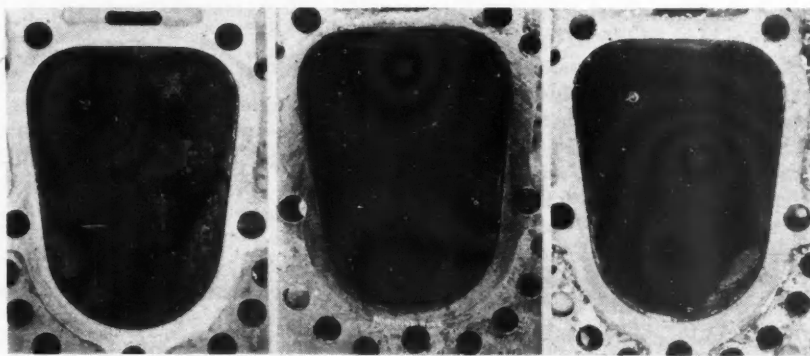
The chart shows that at all speeds the copper alloy head showed a definite improvement in specific fuel consumption.

Another interesting experience found in the experiments at Battelle was in connection with carbon formation. The photographs in Figs. 2, 3 and 4 show the results of 100-hour tests on copper, aluminum and iron heads, there being 25 runs of four hours each at $\frac{5}{8}$ throttle with dyna-

	Carbon Accumulation grams	Fuel Consumption lbs.
Copper0030	271.4
Aluminum0045	323.6
Cast Iron0062	349.3

In this connection it is interesting to note also that oil used during the test was 8.5 oz. for the copper, 7.5 for the aluminum and 5.5 oz. for the cast iron, so that reduction in carbon accumulation is entirely due apparently to changes in combustion characteristics. CO₂ in exhaust gas, indicator of completeness of combustion, was 8.8 per cent for copper, 6.3 for aluminum and 5.5 per cent for cast iron.

Following completion of tests at the Institute, road tests were initiated in actual service on a new six-cylinder car at Lookout Mountain,



Figs. 2, 3 and 4—Accumulations of carbon on cylinder heads of copper (left), aluminum (center) and cast iron (right)

nometer load set to give same horsepower in all cases, the engine being allowed to cool between runs.

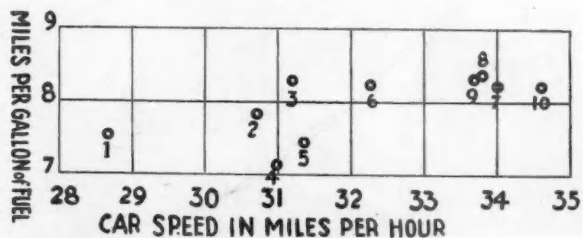
Total carbon accumulation amounts on the copper alloy head to approximately 1/3 of that on the cast iron, and 1/2 of that on the aluminum head. Reduced to carbon accumulation per lb. of fuel, the figures, together with corresponding gasoline consumption data, are:

under the direction of William Taylor, consulting engineer, and also a member of the AAA contest Board.

Fig. 5 shows the result of these tests on a grade 2.7 miles long and ranging from 7 per cent at the bottom to 12 per cent at the top. Again settings were for maximum power as indicated by car speed without detonation on each head tested. The chart shows average miles per hour

Fig. 5—Fuel mileage as related to cylinder head material, compression ratio and car speed (900-lb. load, 8 per cent average grade)

No.	Ratio	Material	Fuel
1	5.8:1	Cast Iron	Regular
2	6.3:1	Aluminum	Regular
3	6.3:1	"	Ethyl
4	6.7:1	"	Regular
5	6.7:1	"	Ethyl
6	6.3:1	Copper	Low Grade
7	6.3:1	"	Regular
8	6.3:1	"	Ethyl
9	7.1:1	"	Regular
10	7.1:1	"	Ethyl



Copper Alloy Cylinder Heads

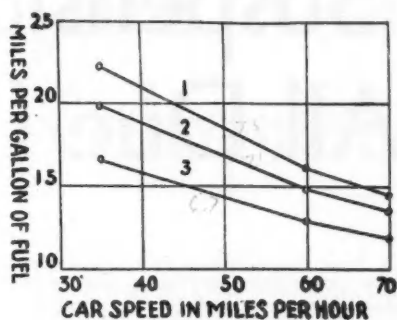


Fig. 6—Dependence of fuel mileage on cylinder-head material and compression ratio, with regular gasoline and 300-lb. load

1, copper head with 7.5:1 ratio; 2, copper head with 7.1 ratio; 3, aluminum head with 6.7 ratio.

to the top of the hill plotted against miles per gallon consumption.

Following these tests, investigations were made on level roads with the same car, as shown in Fig. 6, for example, with settings in each case for maximum top speed and minimum fuel consumption at such speeds. It should be noted here that in all these tests all heads, cast iron, aluminum, and copper, had the same combustion chamber shape, and compression was increased by shaving off the head in order to eliminate all possible variables.

Another series of tests on the heads were conducted at Chris-Craft Corporation, Algonac, Mich. The first of these on a 15½-ft. runabout equipped with standard engine with 11 x 12 in. Federal-Mogul propeller, developed the results shown in Fig. 7. The same chart shows experiments on a standard 24-ft. cruiser with standard four-cylinder engine but fitted with Federal-Mogul 14 x 10-in. propeller.

Regular gasoline was used and spark advance left unchanged in these tests. With the cast-iron head, maximum engine speed was 2300, and with the copper it was 2400 r.p.m. in the case of the cruiser. On the runabout the corresponding top speeds were 3200 and 3360 r.p.m.

Both tests indicate higher horsepower and better fuel economy for the copper alloy head than for the cast iron type, although no attempt was made, we are informed, to change the settings for carburetor and spark found to be best for the cast-iron head to take full advantage of the copper head.

In connection with the tests on the 15½-ft. runabout, it is interesting to note that water outlet temperature was checked at 130 deg. for the cast iron, as against 125 for the copper head.

Fig. 8 shows another chart of further tests on the aforementioned six-cylinder car, carrying the copper head up to 8.0-1.0 ratio. The small gain in car speed over the 7.5-1.0 head is possibly due to the introduction of valve restrictions, etc., since the head was merely shaved down. It will also be seen that the difference in fuel economy for a change of seven-tenths of a compression ratio between the cast iron and aluminum heads is less than for a difference

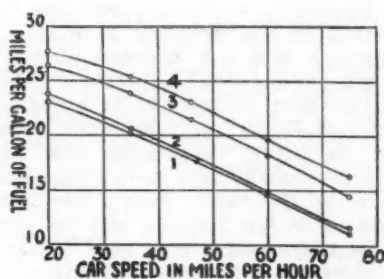


Fig. 8—Fuel mileage of car with different cylinder-head materials and different compression ratios

1, cast iron, 5.8; 2, aluminum, 6.5; 3, copper, 7.5; 4, copper, 8.0.

of five-tenths of a ratio in the copper alloy head.

Fig. 9 shows the test results on another marine engine, a Chris-Craft V-eight. This engine and another similar one with copper heads were fitted in two 26-ft. runabouts which later ran first and second in a race

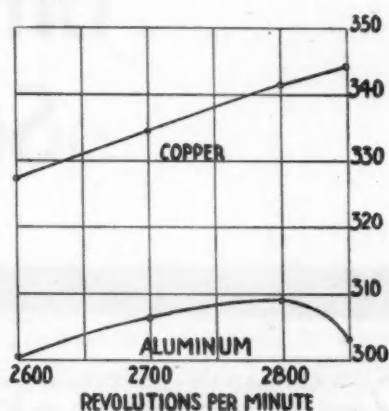


Fig. 9—Effect of cylinder-head material on horsepower of marine engine

for the President of Venezuela's cup during the President's Cup regatta in Washington, D. C., against other similar boats powered with similar engines with standard heads. The gain here was roughly 3.3 m.p.h., or about 6.5 per cent.

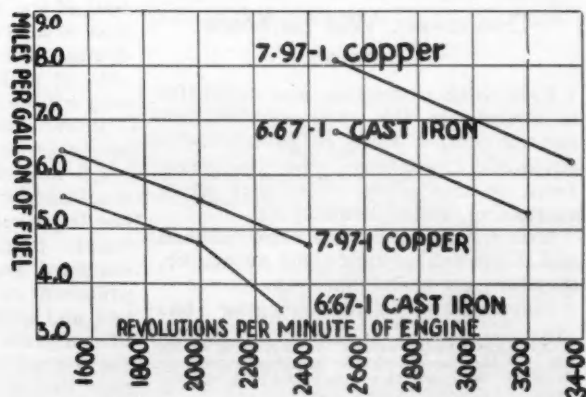
These test data, submitted to *Automotive Industries* by the Federal-Mogul Corporation, seem to show other interesting and in some cases surprising results:

1. Higher compression ratios are practical with copper heads than with other standard materials.
2. Such increases in ratio obviously result in increased power output and improved fuel economy.
3. Even at the same compression ratios the data indicate that fuel consumption is actually better with the copper type of head than with other materials.

4. The data would seem to indicate also that the higher heat transfer coefficient of copper tends toward the elimination of local hot spots.

Fig. 7—Fuel mileage of motor boats as influenced by cylinder-head material

The two curves on the left relate to a 24-ft. cruiser and the two on the right to a 15½-ft. runabout.



Independent Suspension for Streamlining All Due for D

POWERPLANTS of modern passenger cars closely approach in performance those of the racing cars of some fifteen years ago, said Henry M. Crane, technical assistant to the president of General Motors and a past president of the S.A.E., in his talk to the Metropolitan Section last week.* Moreover, they will retain their performance characteristics over a long period, which is more than could be said of most of the racing engines. A resumé of Mr. Crane's comments on other phases of passenger-car design follows:

There is not likely to be much change in clutches. Not so much importance will be attached to power control of clutches as during the past two years.

Transmission improvement recently has been so rapid that it is difficult to realize what has happened in this connection until one drives a car five or more years old.

Improvement of manual control has lessened the incentive to the development of other forms. No automatic control could entirely satisfy every driver under all operating conditions.

Power shifting, which proved a failure when first introduced some twenty years ago, has been rendered entirely practical by the adoption of the synchromesh feature, but it offers little advantage except that it removes the shift lever from the front compartment, so that if the brake lever is also removed, this compartment is free from obstructions.

Overdrives Will be More Common

Cars with overdrives are delightful to operate in the open country, but manual control would be preferable to automatic engagement and disengagement, as this often takes place while overtaking, which is annoying.

Overdrives will become more common and if the public want them automatic, they will get them that way.

Independent front springing has

*Mr. Crane mentioned at the beginning of his talk that the views which he would express were his own personal views and not the official views of General Motors Corp.

shown its practicability and its advantages in large-production cars and is here to stay.

The next step probably will be rear independent springing, but that is a couple of years off and probably will make its appearance first on cars in the higher-price brackets.

Electrical equipment will be improved so the intensity of road illumination will not decrease above 30 m.p.h. and there will be plenty of charging capacity to provide for a radio.

Streamlining has taken such a hold on the public imagination that cars will be made to look more streamlined than in the past. People like their cars to be fast looking, and the same as in times past a long hood conveyed to them the appearance of fleetness, so now an approach to streamlined forms gives that impression.

Actually none of the so-called streamlined cars with seating capacity for five or more passengers has shown a reduction in air resistance that is worth talking about. It is a question whether, in case the car is driven a good deal of the time at moderate speeds, the disadvantages associated with streamlining do not outweigh its real advantages.

Streamlining might be carried to a more logical conclusion if the general arrangement of parts were fundamentally changed, as by placing the engine at the rear, but considerations of safety are opposed to such a change.

Brake development has not kept pace with that of the rest of the car. The soul of the brake is the drum and cast iron is an excellent material for brake drums. Such drums will be made available at sufficiently low prices so that they can be fitted to all cars.

Power braking will be used more extensively on the heavier cars.

An important factor in the development of powerplant efficiency has been the improvement in motor fuels. Few people probably realize that today's standard gasolines are as good as the premium gasolines of some five years ago and infinitely better than those of fifteen years ago. Cooperation between the petroleum and automotive industries through the C.F.R. Committee has

done more than anything else to bring about improvement in the fuel situation.

Mr. Crane cited some figures of maximum car speeds and corresponding engine speeds of current models determined on General Motors proving grounds. One car had a maximum speed of 80.3 m.p.h. with the engine running at 4350 r.p.m.; another showed 82 m.p.h. at 4700 r.p.m. of the engine, and a third, 83.1 m.p.h. at 4700 r.p.m. engine speed. These performances, he said, compared well with those of racing cars of fifteen years ago, and, in making the comparison it must not be overlooked that the passenger-car engine must be as noiseless and vibrationless as possible. All of the cars for which performance figures were given were in the low-priced bracket.

The crankshaft of an average six-cylinder passenger-car engine of today weighs 70-80 lb., or twice as much as the crankshafts for similar engines of 15 years ago. Some of this weight, of course, is in counterweights. Weight has been added also to crankcases and cylinder blocks—to the former because they must hold the crankshaft bearings in line and to the latter because the cylinders must withstand the extra stresses due to higher m.e.p.s.

No Immediate Engine Changes

The speaker said he could not see any change from the conventional type of engine for the immediate future. The four-cycle engine would be continued and would be used principally in four-, six-, and eight-cylinder types. Unless there should be a change to materially smaller cars than are being marketed now, the four-cylinder probably would not be used much. While a certain amount of development work had been done on two-cycle engines recently, there was more justification for such efforts years ago than there was today, because requirements with respect to flexibility of control had become so much more severe, and these were very hard to meet with the two-cycle engine.

The standard type of passenger-car engine had not yet attained the acme of serviceability, but would be further improved and refined. At 4000 r.p.m. all of the parts of the engine must be

for the Rear, Braking and Development, Says Crane

free running if friction losses were to be kept down, yet for quietness the fits of all parts must be close. Not the least contribution toward the improvement in engine performance had been brought about by development of exhaust mufflers. The modern muffler depended upon its action more on tuning than on throttling, and the same principle was being applied in the design of mufflers to silence the intake.

Two types of automatic transmissions were available, the stepped type and the continuous type. One advantage of the latter over the former was that it changes the ratio under full load. An automatic transmission would not remove the need for a big engine, as that was required for maximum speed; engine size would always have to bear a certain relation to total weight, and if nothing could be saved on any part outside the transmission, there was little justification for the additional cost of the automatic transmission.

With the great increase in driving speeds the fuel consumption naturally had increased materially. Tests of fuel consumption at maximum car speeds were made on the proving grounds recently, and the results were rather sad-denning. The lowest mileage checked was six, and the highest 11.4, but the maximum speed of the car which showed this mileage was only 70 m.p.h. This high fuel consumption was due in part, of course, to the large amount of power required to overcome air resistance, but it also resulted from the fact that at maximum car speed the engine operated at a speed at which its specific fuel consumption was high. The overdrive would take care of this.

Most overdrives performed quite satisfactorily, also under ordinary driving conditions when high speeds cannot be maintained. This was due to current practice in powering passenger cars. Most current models had a displacement factor of 110-124 cu. ft. per ton-mile. Quite satisfactory perform-

ance could be obtained with 90 cu. ft. per ton-mile, however.

Proceeding to the chassis as a whole, the speaker said there was nothing as startling in sight as the change to independent front suspension made a year ago. This method of suspension, which had proved its value in large-scale production, permitted the use of front springs of three times the flexibility formerly used. At the same time they permitted the use of much softer tires. Large tires were an advantage not only from the standpoint of comfort, but also from that of appearance.

Independent suspension cost more than the conventional type. Moreover, the advantages of this type of suspension were hardly apparent below 35 m.p.h. But above that speed there was no question as to which of the two types of springing gave the more comfortable ride.

Independent Springing at Rear

Since this development had been started, it should be given further consideration, and rear springing naturally would be the next thing to take up. There were two possibilities, one consisting in the use of the so-called DeDion-type axle, which embodies a rigid axle, the other in providing real independent springing at the rear. The present construction was the cheapest, and whatever gains in comfort were achieved would have to warrant the increased cost.

Not much headway had been made with welded frames, but steering gears had been greatly improved, particularly those of the lower-priced cars. Not so many years ago the steering gears of cars in the low-priced brackets were

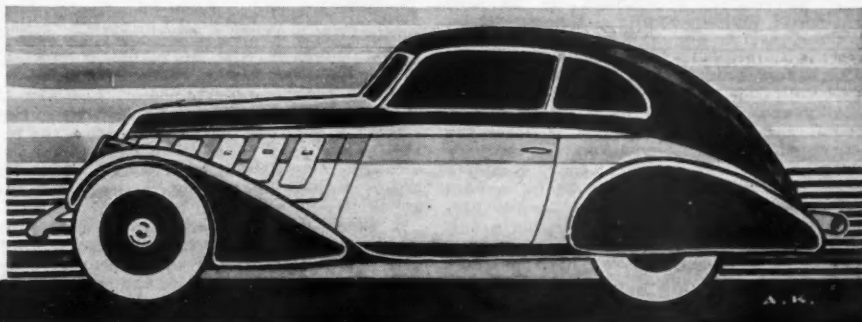
rather crude affairs. With the change to independent front suspension, more weight was placed on the front wheels, and this led to a redesign of the steering gears in order to prevent steering from becoming unduly hard.

There would be improvements also in connection with the various accessories used on the car, and this applied particularly to the electrical equipment. Safety in night driving depended on proper illumination, and this would be provided. Not only would the generators be made larger, but the control would be so changed that there would be no decrease in illumination at the higher speeds.

Another thing that called for an increase in generating capacity on the car was the widespread installation of radios. Statistics had shown that last summer between 2000 and 3000 autoradios were sold per day, so whatever the engineer might think of the situation, the load on the generating equipment had increased greatly.

Streamlining had taken a strong hold on public imagination, evidenced by the wide use of the term in advertising. The speaker said he had not yet heard a tooth brush described as "streamlined," but thought that would come in due time. We had one year of preparatory work along this line, but none of the so-called streamlined cars so far tested, with capacity for five or more passengers, had shown sufficiently less air resistance than the conventional type to make it worth talking about. Inconsistencies in practice were frequent, such as mounting a large tail light above a nicely streamlined rear fender—directly in the air stream. The front lamps also are bad offenders. The designers of the Burlington Zephyr train, although emphasizing the stream-

Streamlining has such a hold on the public imagination that cars will be more streamlined than in the past



lining feature, did not seem to have had much faith in its efficiency, for they reduced the height of the train 3 ft. and the width 1½ ft. as compared with standard railroad practice, and the speaker said he was convinced that this reduction in cross sectional area was much more effective in cutting down air resistance than the streamlining.

Real streamlining was impossible without serious changes in the seating arrangements for the passengers. There

was, of course, the possibility of a complete rearrangement of the chassis units, placing the engine at the rear. Then the question of safety came up, and reference was made by the speaker to an experimental car which when demonstrated at Chicago, rolled over with fatal results. It was a fact that if there were too much weight at the rear, an automobile could go into a spin, the same as an airplane. Some of the stock cars even had this propensity, but fortunately it held only over a nar-

row speed range, which was quickly passed through. To provide against such spins the cars which tried for the world's record at Daytona Beach were provided with tail fins, but these could not be considered for stock cars.

Brakes, said the speaker, had not kept up with the rest of the car. The low-priced cars had increased greatly in weight and therefore needed much more powerful brakes. A good job had been done in improving brakes but still more was required.

Fundamentals of Wear Studied by Bureau of Standards

A SERIES of studies of the fundamental factors involved in the wear of metals has been undertaken at the National Bureau of Standards and was initiated by a study of the influence of the oxygen in the atmosphere surrounding specimens of carbon steel subjected to metal-to-metal wear. A report on this investigation was made at the recent A.S.M. meetings by Samuel J. Rosenberg and Louis Jordan. An Amsler wear-testing machine was used in the investigation, the specimens being enclosed in an oval-shaped cell, properly sealed, in which an atmosphere of hydrogen was maintained in most of the tests, while nitrogen was used in some. Tests were made on a hypoeutectoid, a eutectoid, and a hyper-eutectoid steel (steels of less than 0.9 per cent, 0.9 per cent, and

more than 0.9 per cent carbon).

All of the steels when tested in air showed low rates of wear, and the worn surfaces were smooth and covered by oxide films. Steels tempered at low temperatures also showed low rates of wear in an oxygen atmosphere, and the surfaces were smooth and filmed with oxide. These films, however, were lighter in color and apparently thinner than those formed during the tests in air.

The rates of wear of the steels tempered at higher temperatures and tested in any oxygen-free atmosphere were very high, and the surfaces were very rough and free from film.

Microscopic examination of the specimens having smooth, filmed, worn surfaces showed that the structures adjacent to these surfaces were somewhat distorted and occasionally

contained cracks approximately parallel to the wearing surface. The contours of the worn surfaces appeared smooth even under the microscope.

The microstructures adjacent to rough, film-free, worn surfaces were very severely distorted. Numerous cracks, frequently outlining lenticular areas of distorted metal, were characteristic of this type of wear. The contours of these surfaces appeared extremely irregular under the microscope.

The results of this study are contradictory to Fink's conclusion that no wear takes place between metallic surfaces if oxygen is absent from the surrounding atmosphere. Under certain conditions, at least, the absence of oxygen is conducive to greatly increased rates of wear.

Comments on the Lawrence Articles

HERE'S ONE

Julian Chase, Directing Editor,
Automotive Industries.

Dear Sir:

I cannot let Mr. Joseph Stagg Lawrence's article in your October 6th issue pass without expressing my regret that a magazine like yours, which has heretofore displayed a high degree of editorial intelligence, should publish such a disgusting lot of drivel as the first two paragraphs of Mr. Lawrence's effusion. By what authority does Mr. Lawrence presume to judge anyone's intelligence by using wealth as a yardstick? It might be interesting to know at what exact fraction of an inch on the scale Mr. Lawrence's own intelligence is located by his own method of measurement.

For every single man of wealth or for every generally miscalled "leader of industry" in this country who attained his present eminence through sheer force of intelligence, I am confident that even a casual survey would disclose at least ten others who owe their positions to family or social connections, politics, luck, complete lack of scruples and/or just plain, unvarnished boot-licking. The intelligence displayed by the vast majority of this group so highly praised by Mr. Lawrence is of a type to be ashamed of rather than to boast about and I, for one, am heartily thankful to feel that according to Mr. Lawrence's

way of measuring intelligence, I am a member of the ninety-five per cent class.

If any of Mr. Lawrence's highly touted five per cent had anything but destructive criticism of Mr. Roosevelt's efforts to offer—if any of them would advance a single constructive suggestion—if, as a class, they would utter anything but whining pleas for a return to the "good old ways," the rest of us might take Mr. Lawrence's estimate of their intelligence at somewhere near face value. When anyone of Mr. Lawrence's tin gods shows even a faint glimmer of unselfishness, a minute trace of willingness to concede that perhaps a few of the ninety-five per cent might be entitled to some of the good things of life, or a rudimentary sign of a disposition to buckle down to serious efforts to bring about better times instead of uttering their piteous cries for "expressions to restore confidence"—I will be perfectly willing to apologize to Mr. Lawrence and to concede that he is not completely deluded by the false glimmer of wealth.

Until that unexpected day, however, I shall continue to feel that Mr. Lawrence has offered a silly and entirely uncalled for insult to the very people who have made the wealthy man's wealth possible. Without these people, his highly praised "intelligence" would avail him little.

I would like to see this letter published in rebuttal to Mr. Lawrence's article, but I can hardly hope that it will appear in your magazine, since it might offend some of Mr. Lawrence's (and—by implication—your

own) idols and that, of course, would never do. At least, I hope you will do me the great favor of passing it on to Mr. Lawrence, whom may God give better sense.

Very truly yours,

W. E. HAGEMAN.

[Mr. Lawrence's writings call for little or no expository amplification. It seems clear to the editors that he did not proclaim an inalienable relationship between wealth and intelligence or imply that intelligence is limited to the "upper 5 per cent."—J. C.]

HERE'S THE OTHER

Julian Chase, Directing Editor,
Automotive Industries.

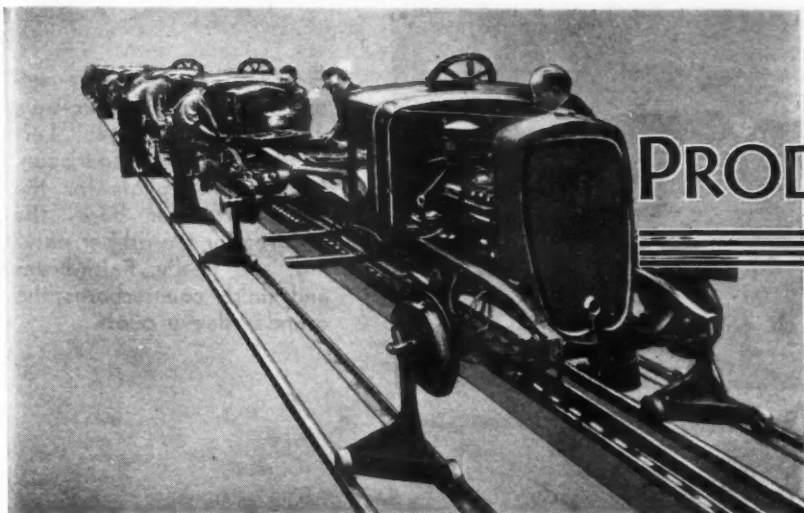
Dear Mr. Chase:

Just a word of good cheer. Your paper in my mind has stepped ahead enormously in the last six months. Your new man Lawrence is on a par with Walter Lippman, and I am very happy to tell you it is a great pleasure to me to see the much higher level at which he writes than we have been accustomed to in the years past.

Your other departments have improved, also, and I just can't help telling you what a great pleasure it is to read your paper each week.

Very truly yours,

H. T. HORNING,
President, Waukesha Motor Company.



PRODUCTION LINES

Suede Spray

Will wonders never cease? Here for many moons Zapon-Brevolite has made available something they call Zapon sprayed izarine finish. By means of a spray gun, you can coat nearly any kind of material with a soft, short-napped, velvety suede-like finish. It comes in 27 different colors; washes clean or can be brushed dry.

Modernizing

One of the fine radiator makers is going modern. This company expects to build a big new plant with equipment that will be the talk of the town. We will tell you about it very soon.

For Speakers

National Safety Council has brought out a pocket-size speaker's manual for people who promote safety. "Speaking for Safety" is an 80-page booklet discussing such subjects as: effective public speaking, the safety movement, accident facts, outlines for safety addresses, etc. We don't know definitely but we suppose that if you're a friend of the cause you can get a copy of this invaluable pocket companion.

Electroplating

As the result of extensive exposure tests of plated steel, a number of important conclusions have been reached by a joint committee of the American Electroplaters' Society, the A.S.T.M., and the Bureau of Standards. They make the following observations: "For severe exposure the nickel coating should be at least one-thousandth inch thick, and for mild or indoor use at least one-half that thickness.

"The presence of a copper layer in very thin coatings decreases their protective value, but in thick coatings, especially if they are chromium plated, a layer of copper is not objectionable.

"Relatively thin chromium coatings, for example, 0.00002 inch, such as are now applied commercially, improve the appearance, and if the previous deposits of nickel and copper are satisfactory, they give good service. For very severe exposure, especially in an industrial atmosphere, much thicker chromium coatings are desirable."

Body Cleaning

Several new developments have been noted by this department in the field of body cleaning prior to finishing operations. One fine car builder is sand-blasting bodies in his new paint shop. And several days ago we were told that a prominent low-priced car maker is trying out a soap steam spray in one of his assembly plants. It will be interesting to see how these processes fare.

Macroscope

Norton had a real cute device at the National Metal Exposition to demonstrate the meaning of controlled structure in grinding wheels. Each visitor was given a souvenir leaflet containing an envelope with a pair of colored (Macroscope) glasses. With this device you squinted at three plates on the reverse side of the sheet. It makes the plates stand out almost in the third dimension showing the grain structure of three different types of wheels. This little stunt created no end of attention.

Durable Goods

No doubt you have heard about the recent reorganization of the Durable Goods Industries Comm., headed by Houston. The story behind this move is rather interesting. First of all, its purpose is to crystallize and express the viewpoint of industry. But to avoid the possible perpetuation of still another agency, the committee is set up as a fact-finding group to study the causes of the present depression. And to function only during the emergency.

Iso-Elastic

John Chatillon, the spring and scale makers, have developed what is thought to be an ideal material for devices requiring precision springs. It is the "Iso-Elastic" material which is a modified Elinvar alloy. Creep effect, hysteresis, and temperature effect are virtually eliminated. Springs made of this alloy are said to exhibit straight line behavior within one part in 6000.

P-F Criterion

B. F. Shepard of Ingersoll-Rand gave the A.S.M. convention a new criterion for the selection of carbon tool steels and their heat treatment. He calls it the P-F characteristic—P for penetration, F for fracture. Penetration is measured directly, while fracture is gaged by comparison with a set of standard fracture specimens. Correlation of the two criteria show exactly what treatment should be used. Thus specific measurements are substituted for terms such as normal and abnormal structure. There is a possibility that the method may be extended to the selection and heat treatment of commonly-used carbon steels.

J. G.



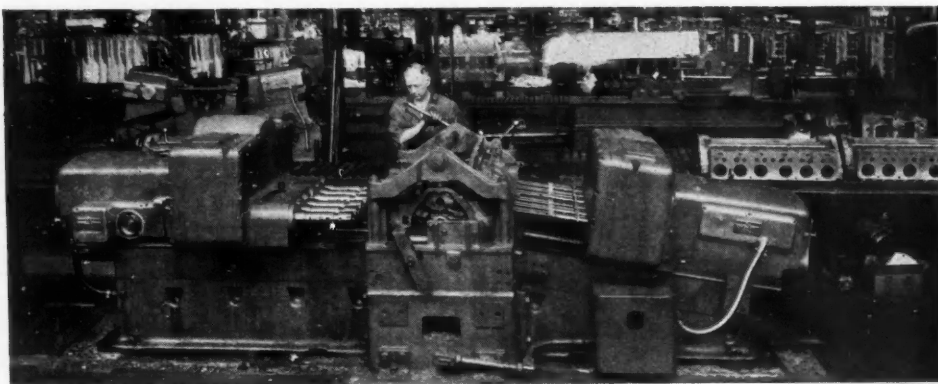


Fig. 1. Three separate set-ups per day on this two-way, 18-spindle machine. Left hand head bores and counterbores the pilots for the wet liner; later bores the grooves for the rubber packing; and finally, finish-bores and finish counterbores the cylinder sleeve pilots.

Unique Production Set-Up Economies on Daily Output

WITH the announcement this week of the White Pancake engine—12-cyl. horizontal opposed, $3\frac{5}{8}$ bore x $3\frac{3}{4}$ in. stroke—The White Motor Company scores three hits. Briefly they are: the development of the first production engine of its kind; the development of a unique truck design incorporating this engine; and the first use in this country of an unusual line of production equipment.

Since the engineering features of the new engine are thoroughly covered elsewhere, we are concerned here with a quick survey of the unique production line designed to machine the Pancake crankcase. And we may add at this point that the desired volume, economy, and precision are guaranteed by an investment of \$125,000 in new machine tools, fixtures and the re-tooling of other machines.

In proof of the novelty of the production equipment installed here, we can start with the statement that the backbone of the crankcase line is a battery of five Power Pack machines by Ingersoll. As will be evident later, this line represents an entirely fresh conception of machine flexibility.

Anyone versed in production planning will recognize that ordinarily the tooling-up of a comparatively small volume job (in terms of passenger car volume) would be accomplished with the use of general pur-

pose machines and the simplest kind of tools and fixtures. At any rate that's how it has been done in the past.

But here is an unusual engine. Its features are—an extremely complicated crankcase structure; great emphasis upon quality and finish; and a high order of precision.

Analysis showed that general purpose equipment would not answer these requirements even though the relatively small volume seemed to demand such equipment. Yet, special single-purpose machines normally would be prohibitive in cost, if amortized over a single model or a single design.

Consider now the way this problem was solved. To the eye, each of the five big Ingersoll machines is a special purpose machine—as much so as anything you can find in a mass production shop. But there the resemblance ceases. With the form of unit construction embodied in these machines, fixtures are designed to handle the block for two or even three separate settings; work units carrying the tooling are quickly detachable and intended to be removed and replaced twice or thrice daily, taking but a few minutes for the change over. We shall show later how this feature permits the shunting of the work through the same machine at least twice a day.

Finally, and this is of greatest

importance to the fiscal management of the company, the capital investment in the line is amply justified on a novel basis. Because the equipment can be readily converted, with but small outlay, to handle a wide variety of production operations, it was shown that the line could handle a larger Pancake engine simply with some tool changes. Or if desired the whole line could be converted, at small additional expense, for an entirely different engine line such as the conventional L-head for example.

This meant that instead of amortizing the equipment program over a short term or over the cost of a single model, which would make the unit cost artificially prohibitive, the major part of the investment could be amortized over a much longer period in absolute safety. A discussion of the machine features that make this possible is quite beyond the scope of this article, but they are there.

Having made this brief inquiry into the economics of the installation, let us trace the course of the crankcase through the major operations at least over the new equipment.

Going over the line we find that all equipment whether it be new or old is connected in proper sequence of operations by a gravity-type, ball-bearing, roller conveyor. Unlike high production lines with duplicate

by
Joseph Geschelin,

Engineering Editor,
Automotive Industries

POTENTIAL volume did not justify single purpose equipment. On the other hand, it was felt manufacturing requirements precluded the use of general purpose machinery.

The accompanying article tells how this problem which confronted White in the production of its new Pancake engines, was solved with an equipment investment of \$125,000. And this equipment can be readily adapted not only to the production of a larger Pancake, but also to the manufacture of other types of power plants.

Not only production men, but engineers will find this description of how it was done intensely interesting.

Gives Mass Production of 16 Pancake Engines

equipment to handle work progressively from station-to-station, the Pancake block takes a more circuitous path threading the same machine several times during the cycle of events.

By virtue of deliberate and beautiful symmetry of design, in many cases the work is turned end-for-end in the same machine to complete similar operations on both banks of cylinders. This is accomplished by

roll-over fixtures or turntables as the case may be, at each station, i.e., the block is finished in a given position, moved out of the fixture, turned and then taken through the same cycle as in the first setting.

In addition, there are certain set-ups in which the work goes through the same machine two or three times, at widely separated steps in the cycle. This occurs for example when bores are first rough-bored and then

finished-bored, or when the case is first multiple-drilled and then tapped. For each change, the work head is removed, replaced by another head, and made ready for the next operation. It's a fine commentary upon the flexibility of the line to remember that the changes mentioned above take place in the regular course of events during each working day.

As the case proceeds over the machine line, it is handled in various dispositions—flat on top or bottom surfaces, on right or left side, or straight up-and-down on front of back surfaces. Roll-over fixtures, turntables, or a suitable hoist mechanism are provided at each point to facilitate handling.

Getting down to the details, the Pancake crankcase is subject to 62 different machine shop operations; two intermediate inspections; a final inspection. The first seven operations are rather conventional and comprise a number of rough and finish milling steps on the various outside pads and surfaces. Perhaps the most important operation in this group is that of "drill, chamfer, and ream two locating dowel holes." These holes serve to locate the work accurately on the fixtures for all subsequent operations.

The eighth operation, performed on the set-up in Fig. 1 is the first example of yeoman duty on the part

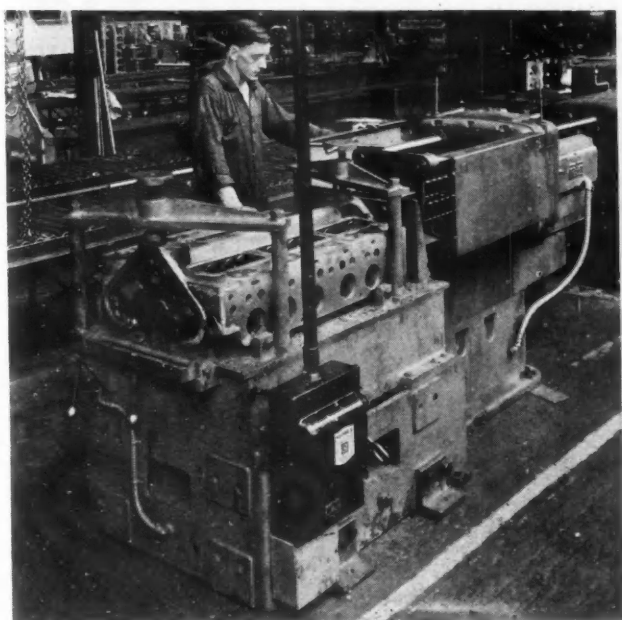


Fig. 2. Biggest job of this one-way drilling machine is the drilling of four longitudinal oil holes. They are drilled half way through in one setting—the rest of the way later in the same machine

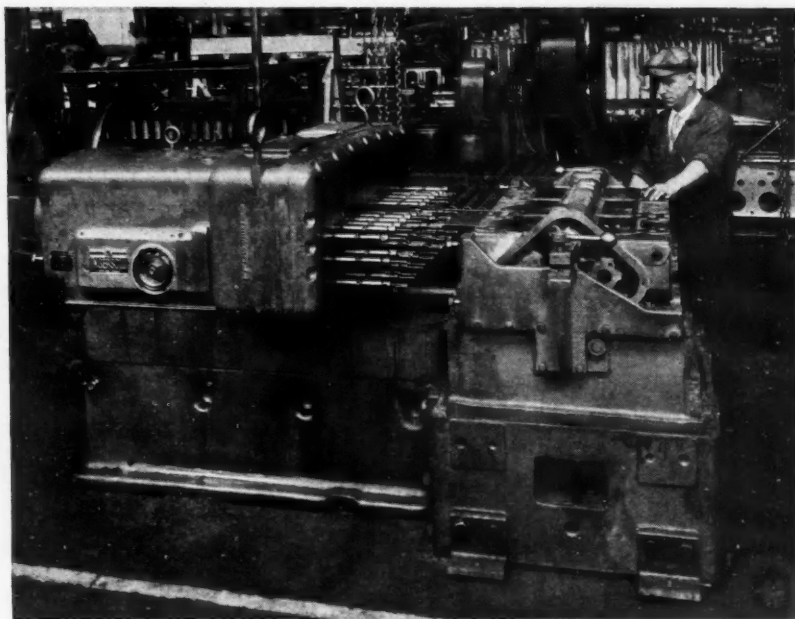


Fig. 3. Here is a 59-spindle, one way drilling and tapping machine. Drills first, then when the block comes back later in the day, a tapping head (shown here) replaces the drilling cluster.

of a seemingly special purpose machine. In fact this one takes three set-ups a day. The machine is a two-way drilling and boring machine with 18 spindles. The first operation is to rough bore valve throats and spot drill the valve guide holes in one bank; and simultaneously rough bore and counterbore the pilot surfaces for the wet liners in the opposite bank. Then the casting is rolled out of the fixture, reversed on a turntable built in the line conveyor, and finished on the opposite side to complete the entire operation on both banks of cylinders.

The work then goes on its way through nine intermediate operations, some of which are to be described presently, and is routed back to the machine in Fig. 1. In the interim the work heads have been changed to permit the following operation: "drill valve guide holes through in one bank, bore cylinder sleeve grooves (for rubber packings) in opposite bank." Then work is rolled out, turned as before, and the operation repeated on the opposite side.

Six other operations take us to operation 21 which is back again at the station in Fig. 1. This set-up is to "rough ream valve guide holes, finish bore and chamfer intake throats and finish bore exhaust

throats in one bank; also finish bore and finish counterbore cylinder sleeve pilots in opposite bank." Again the work is rolled out, reversed, and the operation repeated.

The ninth operation which follows the first set-up in Fig. 1 is shown in Fig. 2. This is an 11-spindle one way drilling machine using 7 spindles. The operation is "drill four longitudinal oil holes from front and half way through, drill one $\frac{3}{4}$ in. hole, drill and countersink two dowel holes in flange."

Again the work traverses nine other operations and comes back to this machine which in the interim has had the work unit changed to a set up comprising six spindles. Here the original four oil leads are drilled half way through from the rear to meet the holes started in the earlier operation, in addition two odd holes are drilled in the rear end.

For the tenth operation we come to the set-up in Fig. 3 which shows a 59 spindle, one-way drilling and tapping machine. Specifically the operation is "drill and countersink stud holes and drill water circulation holes in cylinder head contact surfaces." The work is handled in two settings using 59 spindles for one setting, and 54 for the second in which the block is turned end-for-end.

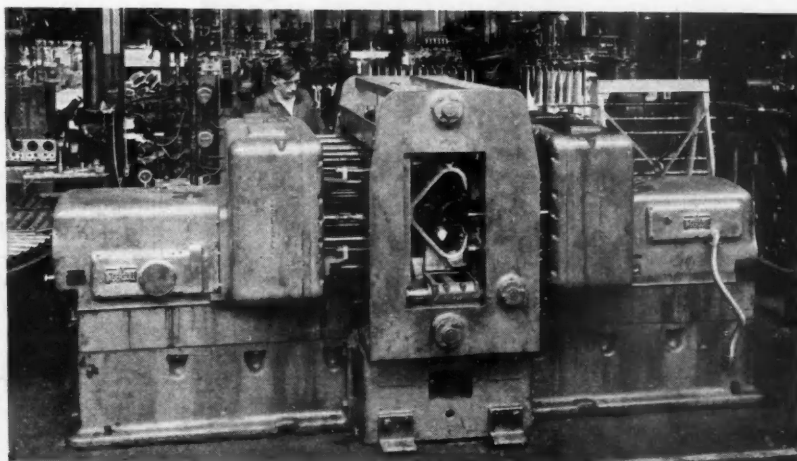
After nine other intermediate steps the case comes back to this machine, now equipped with a 42-spindle tapping head. Again the work is handled in two settings, tapping 42 holes in the first and 38 holes in the second.

Two hundred and four holes are drilled simultaneously in the two-way drilling machine shown in Fig. 4, which handles operation 11. In this machine the case is held straight up-and-down in the fixture, being turned into this position in a roll-over fixture in the conveyor at the side of the machine. The operation is "drill holes in top and bottom, countersink, except bearing cap stud holes." The set-up handles 109 holes in the top and 95 holes in the bottom surface.

Tapping is done in a number of individual steps on various general purpose machines.

One of the most unusual pieces of equipment to be seen anywhere is the set-up shown in Fig. 5, built around a standard radial drill. There are two separate fixtures like leaves, one on each side of the column. With

Fig. 4. 204 holes are drilled simultaneously on this giant two-way machine. Note the roll-over fixture at the operator's station—it sets the block on end from its original flat position.



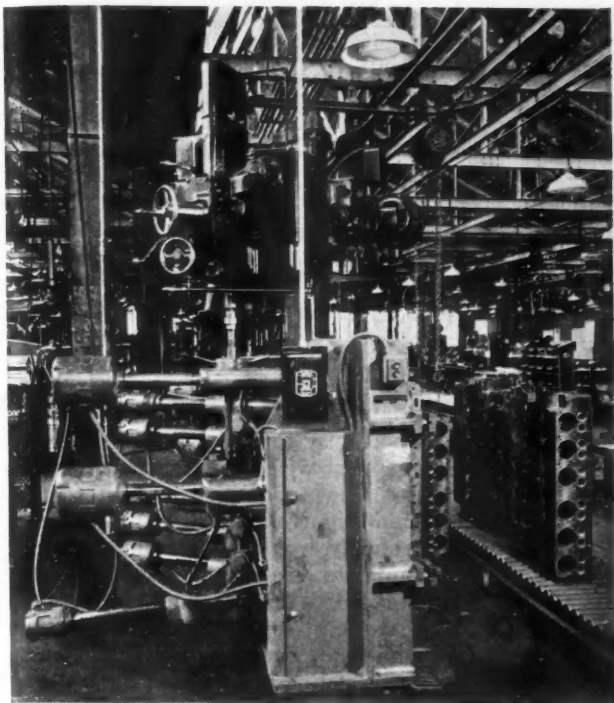


Fig. 5. Two outstanding machines built around a standard radial drill. The outfit at the left has ten individually driven motorized heads.

the case mounted vertically in the fixture on the right, the drill head operates a milling attachment which cuts a clearance slot between adjacent valve ports. Then the work is shifted to the fixture at the left. This is in reality a multiple head machine comprising ten individually driven heads for finishing various angular holes.

The function of the latter set-up is to drill the angular oil holes through the various main bearings and from the rear and center bearings to the camshaft hole. Apart from the multiple heads incorporated in this machine, the most ingenious device is that of providing a feed mechanism for the drilling heads. This is done by the simple (!) expedient of swinging the arm of the radial drill from the right to the left side where it pilots into a vertical outlet in the fixture and transmits the feeding movement from the radial drill proper.

For the 35th operation we come again to a Power Pack machine, Fig. 6. This is a two-way, twelve-spindle machine incorporating a unique mechanical cycle. In operation, a single cluster of spindles on one side is used to rough-bore valve tappet holes in one bank. The opposite side has two sets of spindles very close

together, on opposite sides of the valve tappet holes. One group spot-faces the valve tappet holes, the other spot-faces the spring seats. To appreciate the mechanical movements involved, visualize the two opposed clusters moving into place from both ends of the valve tappet holes toward each other, counter-sinking coaxially and to a precise depth, then separating to clear the work.

When the cycle is completed, the case is rolled out, turned end-for-end on a turntable at the operator's side of the machine, and goes through a similar cycle to finish both banks of cylinders.

Almost at the end of the road we come to the Oilgear hydraulic press, Fig. 7, that does triple duty in just one setting. This machine broaches valve lifter guide holes to size, presses in the guides and broaches the guides simultaneously. This occurs in two steps, i.e., one setting of the work, but two changes of tools. For the first step, the valve lifter holes in the block are broached in one side, broach push rods then are replaced with 12 valve stem guides that are pressed into the block—and with next stroke the valve stem guides are broached to size. The tolerance in valve lifter holes is .0007 inches. The block is then turned over to the other side and operations repeated.

Touching rather quickly on the other high spots, we might mention the fussy operation of counterboring the cylinder bore to shoulder the head of the cylinder liner. With a tool 1.800 in. in diameter, the depth of the counterbore is held to 0.002 in.

In accordance with White practice as described in these columns from time to time, the main and cam bearings are diamond-bored for the final operation.

Another very interesting operation is that of pressing in the camshaft bearings. The problem here is to assure the accurate alignment of the hole in the bearing with the oil lead through the wall of the cam bearing bore. The bearings are mounted on a special bar with spring controlled plungers at each bearing, so located as to hold each bearing hole in the proper position. Then split collars are attached on the bar, one set at each bearing and pressure applied to the bar. The collars move the bearings into their respective

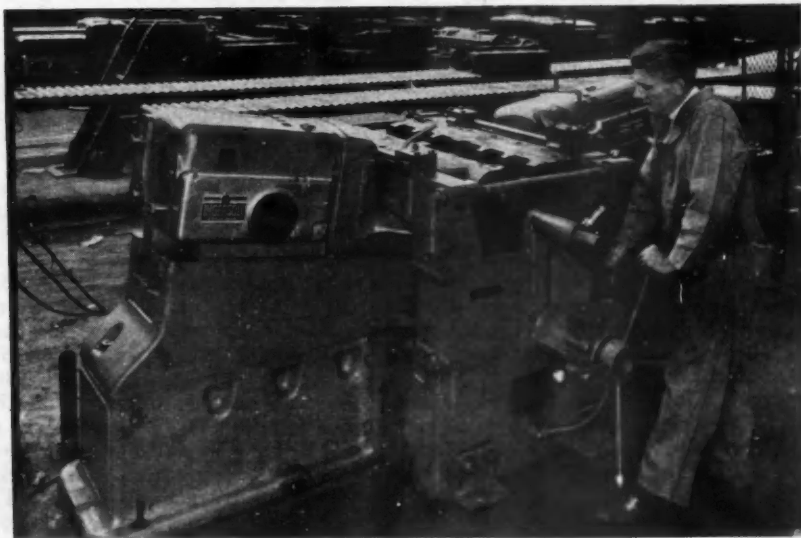


Fig. 6. Two-way, twelve-spindle machine head, in very close quarters, works on both sides of the valve tappet holes counterboring in opposite directions.

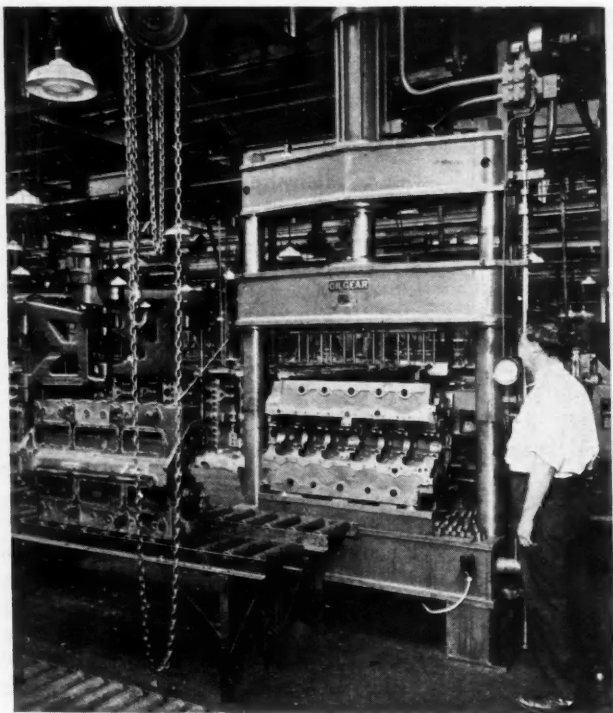


Fig. 7. This Oilgear hydraulic press does triple duty in one setting. It broaches the guide holes in the block, presses in the guides and broaches the hole in the guide to a tolerance of 0.0007 in.

bores while simultaneously the spring actuated plungers find the oil lead, align the bearing accordingly, andpeen it in place.

After the completion of all machining and sub-assembly operations, the block is taken over to a special water test fixture in which both banks of cylinders are subjected to water pressure simultaneously, a

pressure of 80 to 100 lb. per sq. in. being available.

Another bit of mechanical genius is found in the method of transferring the large block from gravity conveyors of different level. The need for some simple transfer device is evident when you consider that the roller conveyor connecting the group of Ingersoll machines is about 30 in.

off the floor whereas the conveyor feeding certain other machines, particularly those in which the block stands on end, is practically at floor level. Many expedients were considered including the use of an overhead hoist but the final solution is a gem. It's simply a scoop made up of small unequal legs or sections of the roller conveyors, suitably counterweighted. It does the trick admirably.

The present layout covered so sketchily above is designed for a production of 16 units per day—which is high production for an engine of this type. If the market expands sufficiently to demand greater output—a most welcome situation indeed—this line undoubtedly would require some changes. Greater productivity probably would have to be met with duplicate equipment which would eliminate some of the doubling back—the most ingenious feature of this line—and thus would approach a straight line layout.

Whatever may be the future course of the layout, we have had the privilege of studying one of the most novel production lines in the automotive industry. And the economics involved should arrest the attention not only of production men but also the fiscal management of automotive parts plants where at present the only solution to small varied production seems to lie in the use of general purpose equipment.

Tolerance in Automotive Production

(Continued from page 468)

the top of the splines; in six models the tolerance varies between 0.004 and 0.012 in. and it may be reasonably assumed that in these cases the sliding gear rides on the bottoms of the spline grooves.

Similarly, the tolerances on sliding-gear inside diameters vary from 0.0005 to 0.007 in. Here, too, where the tolerances are large the surfaces to which they refer do not act as guiding surfaces.

Where the tops of the shaft splines serve as the guiding surfaces the diametral clearance between shaft and gear at the guiding surfaces ranges either between zero and 0.0015 in. or between zero and 0.0020 in. In some cases the sliding gears are assembled selectively with the splined shafts.

On the diameter of the shaft for the reverse-gear idler there is a tolerance of either 0.0005 in. or 0.001 in., more frequently the former. The inside diameter of the bushing in the idler gear is made practically always to a tolerance of 0.001 in. Clearance limits for the reverse-gear shaft in its bushing range from as little as 0.0005-0.002 to as much as 0.003-0.005. The average

clearance allowance is about 0.002 to 0.004 in.

The tolerance on the diameter of the king pin is 0.0005 in. in most cases, but 0.001 in. nearly as many. The tolerance on the bore of the bushings is 0.001 in. in the majority of cases; a few make this part to as close a tolerance as 0.0005 in. while more use a tolerance of 0.0015 on it; the average is very close to 0.001 in. The clearance between the king pin and its bushing ranges from 0.0005 to 0.0025 in. in most cases, though 0.0010-0.0025 and 0.0010-0.0030 ranges are also used.

In fitting the king pin bushings into the holes drilled for them in the knuckle, considerable compression of the bushing is allowed for, as the interference ranges from about 0.0025 to 0.0065 in. In about half of the models the tolerance on the bore for the king pin bushing is 0.001 in.; in the remaining cases it is larger, up to 0.003 in. and the average tolerance on this dimension figures out to very nearly 0.0015 in. Several manufacturers burr-nish the bushings into the knuckle.

Pistons are usually assembled selectively with respect to weight, all those

going into the same engine having to be within certain weight limits. The tolerances range from plus or minus 1/32 oz. (or one gram) to plus or minus 1/2 oz.

There are weight limits also on the connecting rods but here the practice differs widely, the tolerances varying from as little as one gram to as much as 1 oz. (28 grams). No doubt the 1 oz. is the shop tolerance, and the rods are later divided into sets for individual engines with much closer tolerances.

Where gear drive is used for the camshaft and tolerances are set for the backlash between teeth, the minimum is either zero or 0.0005 in. and the maximum ranges from 0.0010 to 0.0030, the average being about 0.0020 in. On rear-axle-drive-gear backlash there is an absolute minimum limit of 0.001 in. and an absolute maximum of 0.012 in. The average limits are 0.004 and 0.008 in. The minimum backlash specified for the differential gears is either zero or 0.005 in., while the maximum going with the zero minimum averages about 0.006 in. and that going with the 0.005 minimum, 0.012 in.